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CATALOGUE

OF

FOSSIL REPTILIA

AND

AMPHIBIA.

PART II.

CATALOGUE

OF THE

FOSSIL REPTILIA

AND

AMPHIBIA

IN THE

BRITISH MUSEUM

(NATURAL HISTORY),

CROMWELL ROAD, S.W.

PART II.

CONTAINING

THE ORDERS ICHTHYOPTERYGIA AND SAUROPTERYGIA.

BY

RICHARD LYDEKKER, B.A., F.G.S., ETC.

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1889.

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REGIA
MONACENSIS

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RED LION COURT, FLEET STREET.

PREFACE.

In the earlier part of this Catalogue Mr. Lydekker was enabled to include the Pterodactyles, the Crocodiles, the Dinosaurs, the Lizards and Snakes, the Rhynchocephalia, and the Proterosauria. The present volume, although of equal size, contains only the so-called Enaliosaurians, comprising two divisions of mostly marine reptiles —the Ichthyopterygia and the Sauropterygia, of which the most important genera, *Ichthyosaurus* and *Plesiosaurus*, are represented by a series of specimens that are probably unrivalled in any other Museum in the world.

But little difficulty has been experienced in dealing with the species of the first order, which, with two exceptions, happily remain all included in the genus *Ichthyosaurus* (the exception being in the case of two species referred to the genus *Ophthalmosaurus* of Prof. Seeley).

The second Order (Sauropterygia) has necessarily been subdivided into four families and into quite a number of genera, as:—*Pliosaurus*, *Peloneustes*, *Thaumatosaurus*, *Polyptychodon*, *Cimoliosaurus*, *Eretmosaurus*, and *Plesiosaurus*, forming the Plesiosauridæ; *Lariosaurus* and *Neusticosaurus*—the Lariosauridæ; *Pistosaurus*, *Nothosaurus* and *Conchiosaurus*—the Nothosauridæ; and *Mesosaurus* the Mesosauridæ.

Of the genus *Cimoliosaurus* (which is taken to include many of the genera of other writers) twenty-eight species are recorded, many of which, however, are founded on very incomplete skeletal remains and are therefore liable to still further revision. This is also true of several other genera included in this Catalogue.

The Author carefully points out that the classification adopted in this Catalogue is not necessarily final, but may serve as a basis on which a more elaborate arrangement may be hereafter constructed, when we possess a fuller knowledge of the forms now so imperfectly known to us.

HENRY WOODWARD.

Department of Geology,
25th April, 1889.

INTRODUCTION.

The present Part is devoted solely to the two Orders Ichthyopterygia and Sauropterygia, which have taken so much space that it has been deemed advisable to postpone the Chelonia till the following Part.

The whole of the species of both these Orders with which the writer is acquainted, dating till the end of 1888, have been mentioned, although it has been found impossible to refer many of those not represented in the Museum to their proper serial position.

In revising the genera and species of these two orders the principle adopted by Prof. Flower[1] in his arrangement of the Cetacea has been followed; species and genera not being recognized as such unless capable of definition by more or less well-marked distinctive characters. Hitherto, the opposite principle has been followed; and it is quite possible that in the present attempt to reduce the number of ill-defined forms the writer may have carried this reduction too far, and that fuller knowledge will eventually show that in some cases more than a single form has been included under one specific heading.

Generic terms, as a rule, have been employed in a wide sense. Thus the genus *Ichthyosaurus* has been retained in the sense in which it is used by previous writers as embracing by far the greater number of the species of the order of which it is the type. In this connection it may be mentioned that there was no real justification for superseding the earlier name *Proteosaurus* by the later *Ichthyosaurus*; but since the latter name has been universally adopted, the writer, after consultation with the Director of the

[1] See Preface to 'List of Specimens of Cetacea in the British Museum' (1885).

Museum, has come to the conclusion that this is one of the cases where an adherence to the rule of priority is not advisable.

In the Sauropterygia a somewhat greater number of genera are admitted than in the Ichthyopterygia; the forms which are included by many writers in *Plesiosaurus* being ranged under four genera, which are mainly defined from the characters of the vertebræ and the pectoral girdle. It has, indeed, been proposed by several writers to divide the forms included in the genus *Cimoliosaurns* into several genera; but at least one of these proposed divisions rests on a misinterpretation, while some of the others do not appear to present well-marked distinctive characters. The forms here included in that genus are readily divisible into two groups distinguished by the characters of the vertebræ; and it is suggested that this distinction may eventually be adopted as a generic one. If, however, this be found advisable, it would be almost obligatory to regard the groups into which the genus *Plesiosaurus* is divided as likewise of generic importance. The various species of the two groups of *Cimoliosaurus* differ greatly among themselves in regard to the structure of the limbs, so far as they are known; and if such differences be regarded as generic, almost every species of which the limbs are known would have to form the type of a genus, while we should be unable to classify at least many of those species in which these appendages are at present unknown. Since the text was in type Mr. A. N. Leeds has forwarded to the writer drawings of the cervical vertebræ and pectoral arch of a *Cimoliosaurus* from the Oxford Clay near Peterborough, which, while agreeing closely with *C. plicatus* in the structure of the cervical vertebræ and the general form of the scapula and coracoid, differs in the absence of a median bony bar connecting the former with the latter. If this be a constant feature of this form it will indicate a well-marked specific character. Since, moreover, the cervical vertebræ of this skeleton (No. 28 in Mr. Leeds's collection) are slightly shorter than those of *C. plicatus*, there is a considerable presumption that this form will prove specifically distinct from the latter, in which event it may be known as *C. durobrivensis*.

It is not presumed that the classification here adopted will be final, or will even meet with general acceptation; but it, at any rate, has the merit of simplicity, and of not overloading the science with a host of generic terms which, at all events for the present, cannot be fully defined, and which would entail the difficulty of leaving us

with many species to which no generic position could be assigned. If, in the course of time, advancing knowledge renders it advisable to introduce a larger number of generic divisions, the present arrangement will form a basis on which a more complicated superstructure may be raised.

The collection of the remains of Ichthyopterygia and Sauropterygia preserved in the Museum is, as a whole, the finest in Europe, and probably in the world; containing a large number of type specimens. Through the courtesy of Prof. A. H. Green, of Oxford, Prof. T. McKenny Hughes, of Cambridge, Mr. A. N. Leeds, of Eyebury near Peterborough, and Dr. W. King, Director of the Geological Survey of India, the Collection has been enriched during the progress of the present work with casts of type and other important specimens belonging to nearly all the English forms to which specific names have been applied; these casts having been moulded by the skilful hands of Mr. C. Barlow, the Museum formatore.

Leaving the subject of the present volume, it is necessary to draw attention to certain erroneous determinations made in the previous volume, and also to emendations in regard to some of the forms and specimens therein mentioned. In some of these points the writer is indebted to Prof. O. C. Marsh, who visited the Museum during the autumn of 1888.

In the Ornithosauria the name *Ptenodracon* (p. 3) may be amended to *Ptenodraco*. Passing to the Crocodilia, it has been found that the genus *Geosaurus* (Pt. I. p. 271) is really a Crocodilian; and since it appears that *Dacosaurus* (p. 92) is not separable therefrom, Plieninger's name of *Geosaurus maximus* may be retained for the type of the latter. Dermal scutes are absent both in this genus and *Metriorhynchus* (p. 95), but sclerotic plates were present in the eye; which entails an amendment in the characters of the Crocodilia given on p. 42. This also shows that the loricate Crocodilian mentioned on p. 98, to which the name *Crocodilæmus* has been applied, is distinct from *Metriorhynchus*. See 'Quart. Journ. Geol. Soc.' vol. xlv. pp. 56–58 (1889).

In the Dinosauria the apparent resemblance of the vertebræ of *Bothriospondylus suffosus* (p. 170) to the figure of the vertebra of *Creosaurus* is not a real one; and these specimens belong to an immature Sauropod, or may perhaps indicate a smaller form allied to the American *Pleurocœlus*, which may be the same as *Cetiosaurus*

humerocristatus or *manseli*. The vertebra of *B. robustus* is probably also referable to the same suborder, and may belong to an immature *Cetiosaurus*.

It has been recently pointed out by the writer[1] that teeth from the Forest Marble described by Owen[2] as *Cardiodon rugulosus* are probably referable to *Cetiosaurus oxoniensis*, in which event the former name should replace *Cetiosaurus*, and the family name *Cardiodontidæ* that of *Cetiosauridæ*. It should also be observed that it has recently been stated by Prof. Prestwich[3] that the bones of *Cetiosaurus* preserved in the Oxford Museum, of which the casts are entered on p. 138, are from the Forest Marble, and not from the Great Oolite, as stated by Phillips.

The writer's attention has been directed to the circumstance that the name *Hoplosaurus armatus* has been applied by Gervais[4] to the Dinosaur represented by the tooth figured in Part I. p. 147, and provisionally referred to *Ornithopsis*. If this reference be correct the name *Hoplosaurus* must supersede *Ornithopsis*; but on reflection, the author considers that there is no justification for the suggestion made on p. 145 of the same Part that the still earlier name *Pelorosaurus*, if likewise identical, should not be adopted. In any case, *Pelorosaurus*, based on the humerus, and *Hoplosaurus* on the tooth, are respectively the first and second names proposed for the members of the family of Sauropoda provisionally termed *Atlantosauridæ*, and therefore supersede all those mentioned on p. 146 of Part I. The jaw No. R. 751 (p. 147) appears to be part of the left dentary instead of the right maxillary.

The teeth provisionally referred by Mantell and Owen to *Hylæosaurus*, and entered on p. 185 under that heading, appear to be Sauropodous, and have the relatively small size of the teeth (*Cardiodon*) referred by Phillips to *Cetiosaurus oxoniensis*; it is possible that this type of tooth may prove to belong to *Cetiosaurus brevis*, or it may indicate a smaller form. Prof. Marsh[5] has referred the

[1] Quart. Journ. Geol. Soc. vol. xlv. p. 245 (1889).

[2] Odontography, pt. ii. p. 291, pl. 75 A. fig. 7 (1841). It may be mentioned that the dates of publication of the three parts in which this work originally appeared are, according to Engelmann, as follows, *viz.*—

Part 1 (1840)—plates i.–ii. and 1–48.
„ 2 (1841)— „ 49–87.
„ 3 (1845)— „ 87 *a*–150.

[3] Geology, vol. ii. p. 211 (1888).

[4] Zool. et Pal. Françaises, 1st ed. p. 263 (1849-52). See also 2nd ed. p. 464 (1859). The name is here given as *Oplosaurus*.

[5] Amer. Journ. ser. 3, vol. xxxvii. p. 325 (1889).

limb-bones No. 28701, p. 142, to *Morosaurus*; and if, as suggested on p. 143, these specimens be referable to *C. brevis*, they would serve to confirm the affinity between *Cetiosaurus* and *Morosaurus*.

The calcanea mentioned on p. 225, and provisionally regarded as Iguanodont, are recognized by Prof. Marsh as Sauropodous.

Ornithopsis leedsi (p. 151), although stated by its describer to be from the Kimeridge, is really from the Oxford Clay, and may therefore be distinct from *O. humerocristatus*.

The removal of the above-mentioned teeth from *Hylæosaurus* likewise removes the objection of Owen's identification of *Regnosaurus* with the former; but *Regnosaurus* may, so far as can be seen, be equally well identical with the later *Polacanthus*, although apparently too large to be the same as *Vectisaurus*.

The name *Omosaurus* (p. 177) is preoccupied by Leidy (1856); but since it is highly probable that the Owenian *Omosaurus* is not generically separable from *Stegosaurus* (the small inner femoral trochanter being a very insignificant point of difference), it seems inadvisable to propose a new generic name for the European form.

Iguanodon prestwichi (p. 196) has been provisionally referred by the writer (Quart. Journ. Geol. Soc. vol. xlv. p. 47, 1889) to *Camptosaurus*; and the undetermined femur mentioned on p. 195, and the mandibular ramus No. R. 180, p. 227, have been referred to the same genus, as *C. valdensis*.

The writer is rather inclined to the opinion which was suggested in Part I., that some of the portions of pectoral and pelvic girdles entered under the head of *Iguanodon Bernissartensis* may indicate another large species of Wealden Iguanodont.

In the diagnosis of the Pythonomorpha (p. 261), Prof. Cope has been followed; and it has been omitted to notice that Prof. Marsh has figured a sternum in one genus.

In regard to particular specimens, the following emendations may be made:—

P. 150. No. **R. 212** is the proximal extremity of a fibula.

„ No. **R. 97.** In a paper recently read before the Geological Society, it has been shown by Seeley that the describer of the pelvis of *Ornithopsis* has mistaken the ventral for the dorsal surface, and that the specimen consequently belongs to the left side. The other Sauropodous pelvic bones are in consequence referred to the opposite side to that to which they really belong.

P. 152. No. **32498** is a radius.

P. 161. No. **R. 1027** is Middle and not Lower Jurassic, and may therefore be specifically distinct from *Megalosaurus bucklandi*.

Further observations on some of the above-mentioned forms and specimens will be made in a Supplement at the end of the work, when some Crocodilian and Dinosaurian specimens recently acquired will be entered.

The undermentioned Collections are not mentioned in Part I.:—

Capron Collection.—A small collection, purchased in 1879 from Mr. J. R. Capron, of Guildford.

Cracherode Collection.—A few specimens (among a large collection of minerals) bequeathed in 1799 by the late Rev. C. M. Cracherode, formerly an Officer of the Museum.

Cunnington Collection.—In addition to the collection purchased in 1875, and mentioned in Part I., an earlier collection was also purchased from Mr. Cunnington in 1849.

Enniskillen Collection.—Purchased in 1882 from the Right Hon. the Earl of Enniskillen, D.C.L.

Gardner Collection.—A series of specimens from the English Cretaceous, purchased, from 1876 to 1880, from Mr. J. Starkie Gardner, F.G.S.

Cowderoy Collection.—Presented in 1852 by Miss Cowderoy.

Harford Collection.—Purchased in 1888, from Mr. F. Harford, of South Norwood.

Hawkins Collection.—A magnificent series of remains of the so-called Enaliosaurians of the Lower Lias, collected by the late Mr. Thomas Hawkins, and purchased by the Museum in 1834.

Taylor Collection.—A small series of specimens from the Cretaceous of the South of England, purchased in 1854, at the sale of the collection of the late Mr. H. W. Taylor, of Brixton.

RICHARD LYDEKKER.

Harpenden,
March, 1889.

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[Doubtful species are denoted by two asterisks.]

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[1] Erroneously described as *pelvic* in the text.

ABBREVIATIONS OF SERIALS QUOTED IN THIS VOLUME

IN ADDITION TO THOSE OF WHICH A LIST IS GIVEN IN PART I.

[Where not otherwise stated, the works are in 8vo.]

Amer. Geol.—American Geologist. *Minneapolis.*

Ann. Sci. Nat.—Annales des Sciences Naturelles. *Paris.*

Bericht. oberrhein. geol. Verein.—Bericht über die Versammlung der oberrheinischen geologischen Vereins. *Various German Towns.*

Bihang K. Svensk. Vet.-Akad. Handl.—Bihang till K. Svenska Vetenskaps-Akademiens Handlingar. *Stockholm.*

Bull. Soc. Moscou.—Bulletin de la Société impériale des Naturalistes de Moscou. *Moscow.*

Bull. Soc. Vaud.—Bulletin de la Société Vaudoise des Sciences Naturelles. *Lausanne.*

Gelehrte Anzeigen.—Gelehrte Anzeigen der königlich-bayerischen Akademie der Wissenschaften. *Munich.*

Giorn. I. R. Ist. Lombard.—Giornale del I. R. Istituto Lombardo di Scienze. *Milan.*

Jahrb. preuss. geol. Landesanst.—Jahrbuch der königlich preussischen geologischen Landesanstalt und Bergakademie zu Berlin. *Berlin.*

Journ. R. Dublin Soc.—Journal of the Royal Dublin Society. *Dublin.*

Mém. Ac. Imp. St. Pétersbourg.—Mémoires de l'Académie impériale des Sciences de St. Pétersbourg. 4to. *St. Petersburg.*

Mém. Ac. R. Belg.—Mémoires de l'Académie royal des sciences, etc., de Belgique. 4to. *Brussels.*

Mem. I. R. Ist. Lombard.—Memorie del I. R. Istituto Lombardo di Scienze. 4to. *Milan.*

Proc. Linn. Soc. New South Wales.—Proceedings of the Linnean Society of New South Wales. *Sydney.*

Rep. Yorks. Phil. Soc.—Annual Report of the Yorkshire Philosophical Society. *York.*

Zeitschr. deutsch. geol. Ges.—Zeitschrift der deutschen geologischen Gesellschaft. *Berlin.*

CORRIGENDA TO PART I.

Page 153, note 4, *for* p. 400 *read* p. 440.

„ 155, line 22 from top, *after* opisthocœlous *add* or amphicœlous.

„ 158, line 7 from bottom, *for* p. 27 *read* p. 222, and in lines 10 and 12 from bottom, *for* p. 27 *read* p. 227.

CATALOGUE

OF

FOSSIL REPTILIA

AND

AMPHIBIA.

Class **REPTILIA.**

STREPTOSTYLIC BRANCH (*continued*).

Order ICHTHYOPTERYGIA.

According to the arrangement of Baur [1], who in this respect follows the lead of Owen, the Ichthyopterygia are provisionally included in the Streptostylic branch, of which they constitute a well-defined order modified for a marine existence, and retaining certain Labyrinthodont features which are lost in the other orders [2].

[1] Biol. Centralblatt, vol. vii. pp. 482, 486, 491 (1887). See also Amer. Nat. vol. xxi. p. 837 (1887); and Bericht xx. Versamml. oberrhein. geol. Verein. p. 18 (1887).

[2] Cope, Amer. Nat. vol. xix. p. 245 (1885), has proposed to place the Ichthyopterygia in a division ranked as of equal value with that containing all the other Reptiles. Seeley, 'Phillips' Manual of Geology,' 2nd ed. pt. i. pp. 515–517, has proposed to affiliate this order with the Dinosauria.

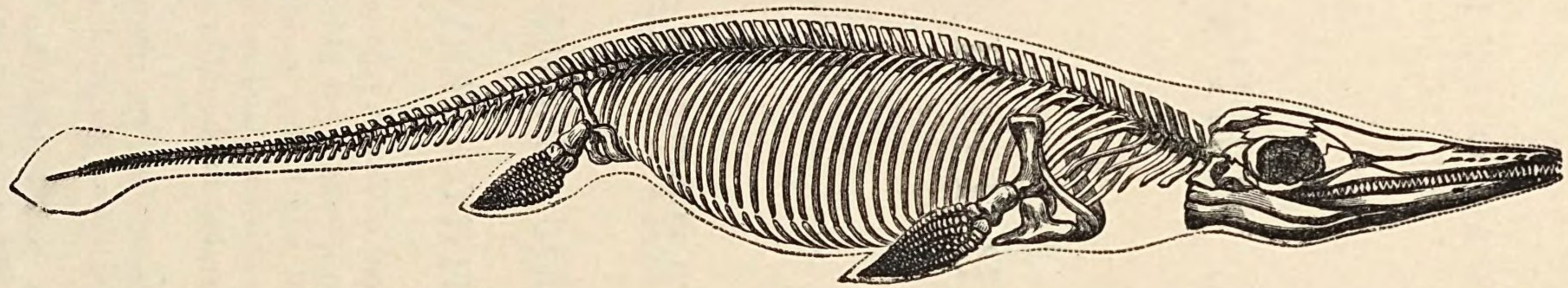
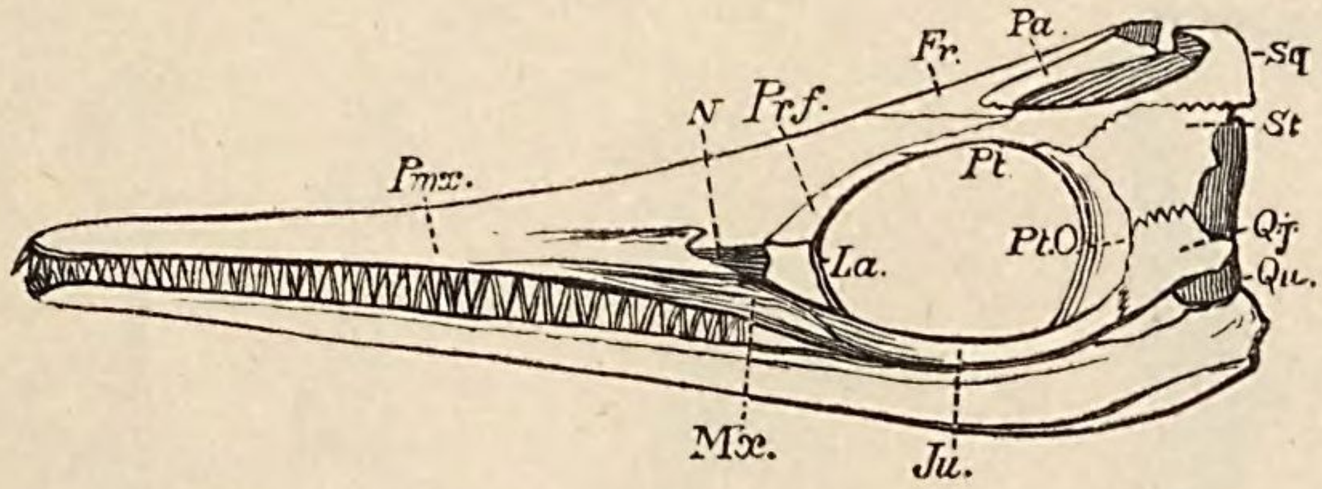


Fig. 1.—*Ichthyosaurus communis.*—Right lateral aspect of the skeleton; from the Lower Lias of Dorsetshire. Much reduced. (*After Owen.*)

Carnivorous Marine Reptiles with a Cetacean-like body (fig. 1), devoid of exoskeleton, and with the limbs modified into paddles, in which the proximal (propodial) segment is very short; the phalangeals are ovoid or polygonal, and articulate together to form a kind of pavement, the number in each digit being increased beyond the normal, and frequently additional digits are developed. Skull

Fig. 2.



Ichthyosaurus intermedius.—Left lateral view of skull; from the Lower Lias of Lyme-Regis. Reduced. *Pmx*, premaxilla; *Mx*, maxilla; *N*, nares; *La*, lachrymal; *Prf*, prefrontal; *Fr*, frontal; *Pa*, parietal; *Pt*, postfrontal; *St*, supratemporal; *Sq*, squamosal; *Qj*, quadratojugal; *Qu*, quadrate; *Ju*, jugal; *PtO*, postorbital. (*After Huxley.*)

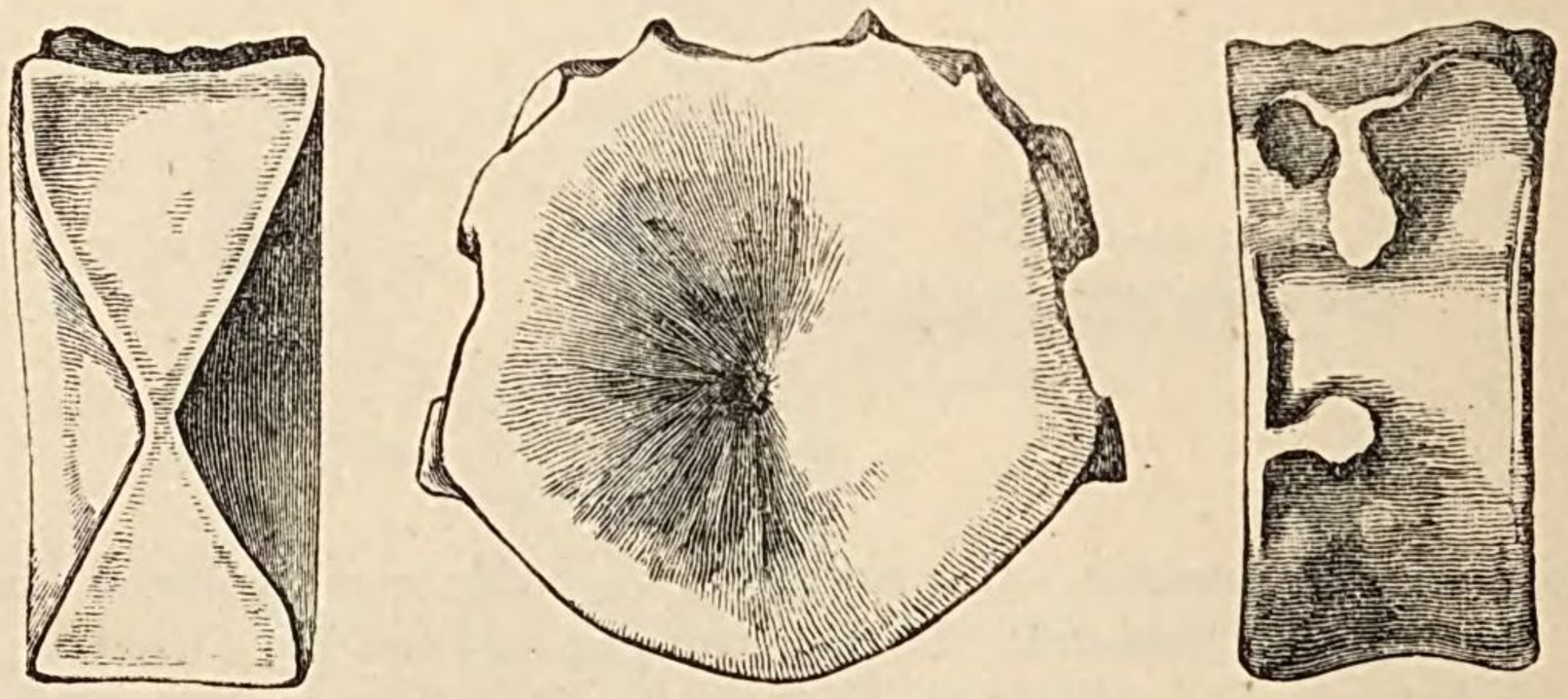
(fig. 2) large, with an elongated rostrum principally constituted in the cranium by the premaxilla; nares approximated to the large orbit, in which the sclerotic has an ossified ring; a parietal foramen; postorbital distinct from postfrontal, and lachrymal from prefrontal; frontal minute; quadrate fixed, not fused with pterygoid, and separated from middle of quadratojugal by a foramen; a columella (epipterygoid); a distinct opisthotic; two temporal arcades, connected together by the supratemporal [1], which roofs over the infratemporal fossa. Teeth confined to the jaws, implanted in a groove, without anchylosis; the crowns usually cylindrical and fluted, but occasionally compressed, carinated, and smooth. Vertebræ (fig. 3) primarily divisible into a precaudal and caudal series without any differentiated sacrum; centra very short and amphicœlous; precaudals (fig. 3) with an upper and a lower costal tubercle on the centrum [2]; caudals with a single tubercle; neural

[1] In the nomenclature of this bone the usual determination is followed. Baur, however (Anat. Anzeig. vol. i. p. 348, 1886, and vol. ii. p. 657, 1887; see also Amer. Nat. vol. xxi. p. 838, 1887), reverses the names of the two bones here termed supratemporal and squamosal. The bone here termed supratemporal is the prosquamosal of Owen, and the supraquadrate of Seeley; and is identified by Baur with the squamosal.

[2] In the first few vertebræ the upper tubercle may be partly or entirely on the arch.

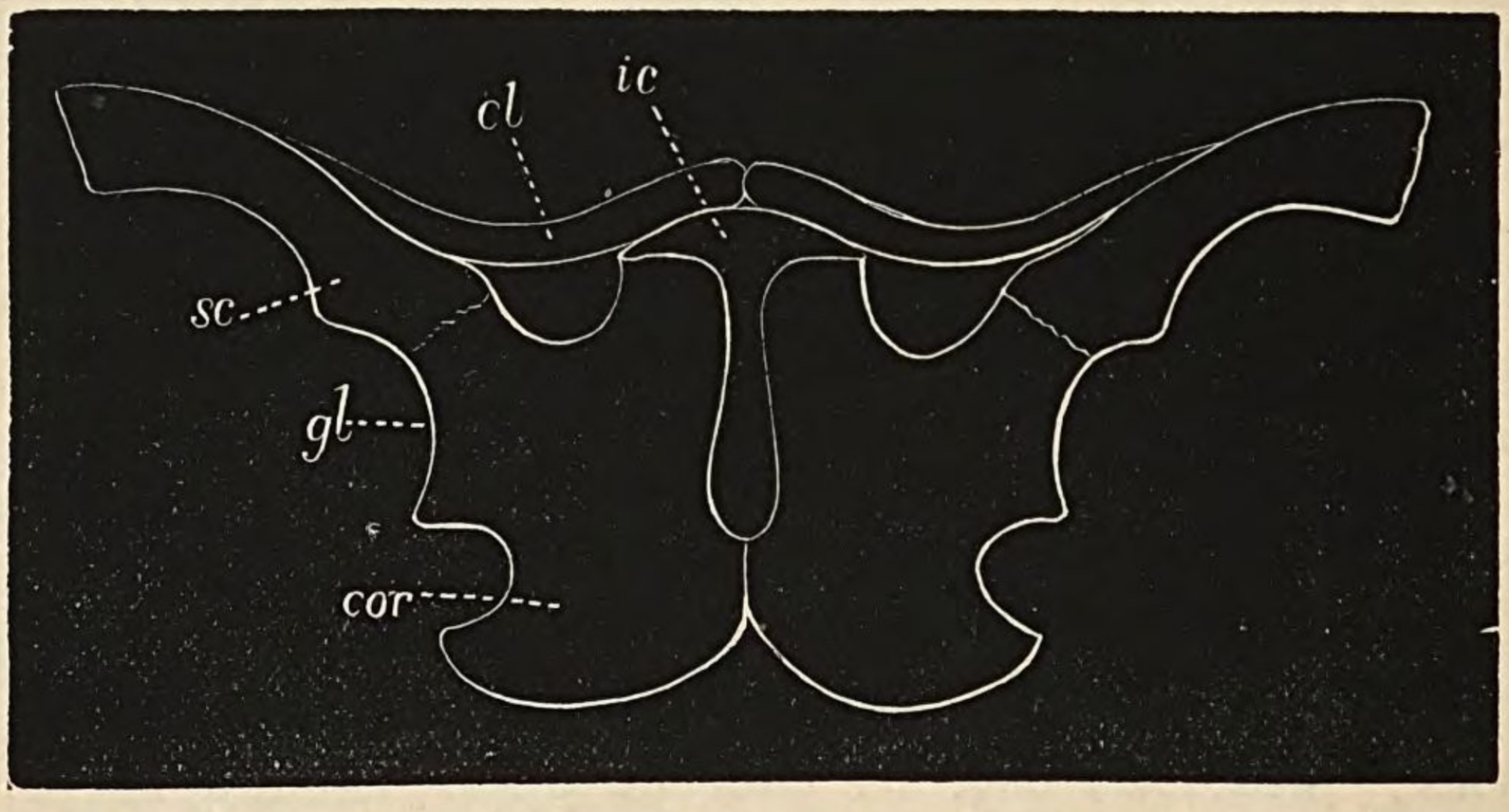
arches attached by synchondrosis to flat surfaces on centrum. Intercentra between the skull and atlas, and between atlas and axis. Dorsal ribs double-headed. Ribs present in the caudal region; no uncinate processes; chevrons not united inferiorly. Abdominal ribs present; no sternum. In pectoral girdle (fig. 4) clavicles and a T-shaped interclavicle; coracoids not overlapping, and

Fig. 3.



Ichthyosaurus (*cf.*) *entheciodon*.—The centrum of an anterior dorsal vertebra, viewed in section, and from the anterior and left lateral aspects; from the Kimeridge Clay of Wiltshire. ½.

Fig. 4.



Ichthyosaurus (*cf.*) *communis*.—Ventral aspect of the pectoral girdle. Reduced. *ic*, interclavicle; *cl*, clavicle; *cor*, coracoid; *sc*, scapula; *gl*, glenoid cavity. (From the 'Proc. Geol. Soc.')

without fontanelle; no distinct precoracoid. Pelvis weak; ilia not connected with vertebræ; and an open obturator notch. Humerus and femur much longer than radius and tibia; no foramen in humerus; when one limb is longer than the other the superiority is with the pectoral.

In the precaudal portion of the vertebral column the costal tubercles gradually descend from the summit to the base of the lateral surfaces of the centra; and since in some forms the superior costal tubercle of the anterior vertebræ is placed partly or entirely on the arch, it will be convenient to call such vertebræ or their homologues cervicals, and the succeeding ones dorsals. In the early posterior dorsals the two tubercles may coalesce.

Some diversity of view obtains as to the homology of the three bones which articulate with the distal extremity of the humerus and femur in the genera *Ophthalmosaurus* and *Baptanodon*. By Marsh [1] and Hulke [2] these bones in the pectoral limb are correlated with the radius, intermedium, and ulna; Seeley [3], on the other hand, terms them radius, ulna, and olecranon; while Baur [4], whose view is provisionally adopted in the sequel, considers that they represent the radius, ulna, and pisiform.

It has been almost conclusively shown by Baur [5] that the Ichthyopterygia have taken their origin from terrestrial or amphibious animals. The structure of the limbs in the more generalized species of *Ichthyosaurus* (fig. 32, p. 89) indicates that the pectoral limb primarily consists of only four digits; the first digit being unrepresented, and the fourth and fifth arising in the usual manner from the ulnare. The additional longitudinal rows of phalangeals in the more specialized forms (fig. 23, p. 57) being due to a splitting of the radial (2nd) and intermedial (3rd) digits, the presence of two centralia in the carpus of these higher forms is therefore an acquired and not an inherited character.

The structure of the palate is essntially the same as in *Sphenodon*, the pterygoids extending forwards to exclude the palatines (transverse bones of Owen [6] and Seeley [7]) from the middle line. There is a parieto-squamosal (post-temporal) bar.

In regarding the Ichthyopterygia as nearly related to the Rhynchocephalia, Baur [8] lays stress upon the remarkable resemblance presented by the structure of the pectoral arch, of the abdominal ribs, and of the cranial region to those of *Sphenodon*. The latter resemblance is exemplified by the similar position of the parietal foramen; the relations of the quadratojugal to the surrounding bones, and especially the separation of its middle portion from the

[1] Amer. Journ. ser. 3, vol. xix. p. 491 (1880).
[2] Proc. Geol. Soc. for 1883, p. 55.
[3] Quart. Journ. Geol. Soc. vol. xxx. p. 705 (1874).
[4] Bericht xx. Versamml. oberrhein. geol. Verein. p. 18 (1887).
[5] Zool. Anzeig. vol. ix. pp. 245–252 (1886).
[6] See p. 78. [7] See p. 79.
[8] Amer. Nat. vol. xxi. p. 838 (1887).

quadrate by a foramen; and the form and position of the stapes [1] and columella. These conclusions are confirmed by the structure of the palate. The absence of a lateral vacuity in the mandible is, as was first pointed out by Owen, another character of the Rhynchocephalia and Squamata; while the backward position of the nares is merely due (as in the case of the Parasuchian Crocodilia) to the excessive development of the premaxillæ.

The Labyrinthodont features shown in this order, which are lost in the other members of the Streptostylic branch, are the distinctness of the lachrymal from the prefrontal, and the roofing over of the infratemporal fossa by the separate squamosal and supratemporal.

The distinct opisthotic is also a very generalized feature, at present known elsewhere in the class only in the Chelonia, and probably in *Pariasaurus*. The discoidal vertebral centra are also markedly Labyrinthodont; but the transference of both costal articulations to the centrum may be an adaptive feature. Miall [2] remarks on the resemblance of the pectoral girdle to that of the Labyrinthodonts.

Family ICHTHYOSAURIDÆ.

All the known members of the order are included in this family, which is for the present taken to embrace the *Baptanodontidæ*, *Ophthalmosauridæ*, and *Mixosauridæ* of other writers [3].

Genus **BAPTANODON,** Marsh [4].

Syn. *Sauranodon,* Marsh [5].

Distinguished from the following genus by the total absence of teeth and of a dental groove in the jaws.

Baur [6] has suggested that this genus is probably not separable from the next, a view which was provisionally adopted by the writer [7] in a paper on the Ichthyopterygia.

[1] In *Ichthyosaurus*, the bone marked 4 in plate xxvi. of Owen's 'Liassic Reptilia' (Mon. Pal. Soc.), pt. 3 (1881).

[2] Rep. Brit. Assoc. for 1873, p. 241.

[3] See Baur, Amer. Nat. vol. xxi. p. 840 (1887).

[4] Amer. Journ. ser. 3, vol. xix. p. 491 (1880).

[5] *Ibid.* vol. xvii. p. 86 (1879).—Preoccupied.

[6] Bericht xx. Versamml. oberrhein. geol. Verein. p. 21 (1887).

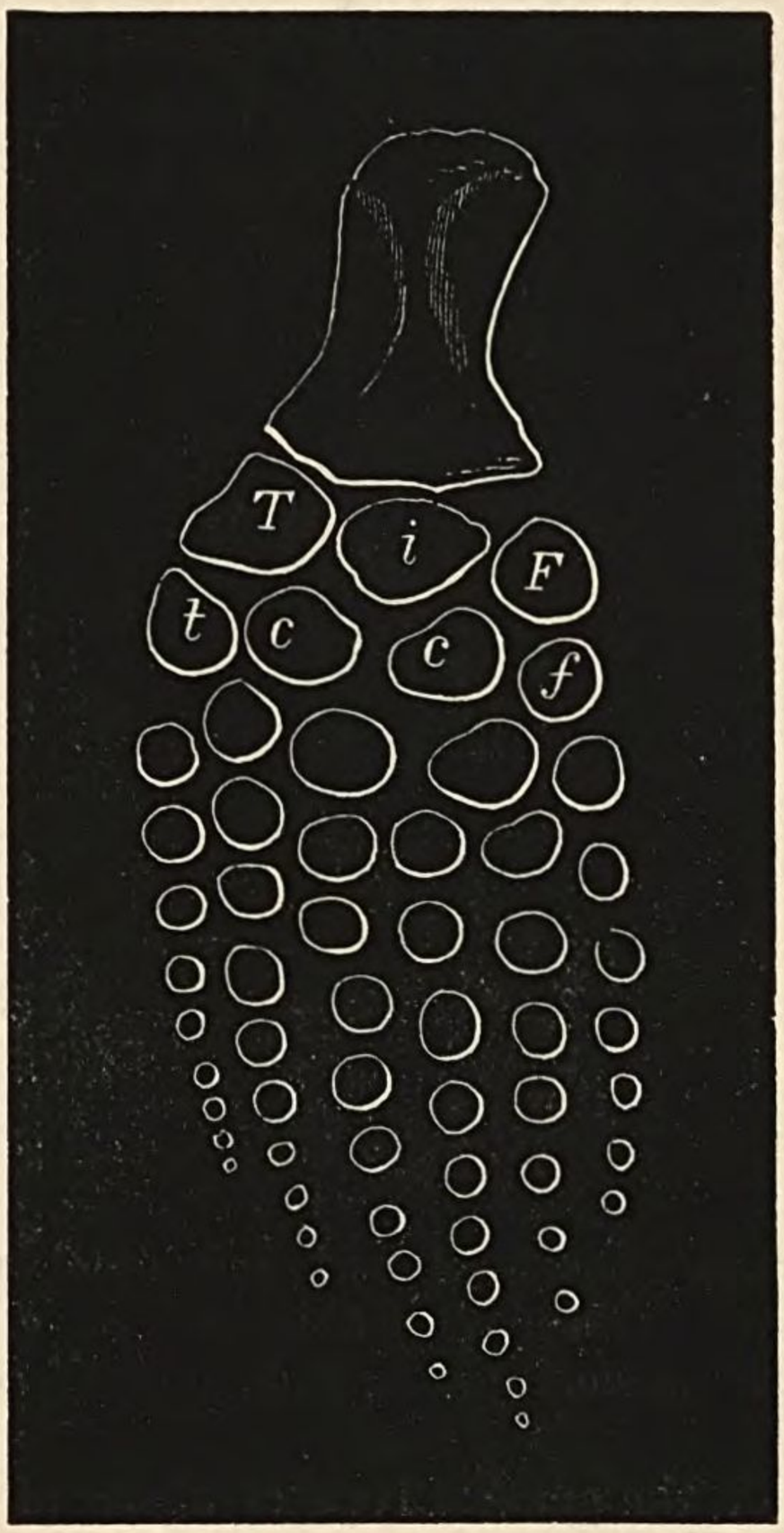
[7] Geol. Mag. dec. 3, vol. v. p. 309 (1888).

This genus is at present unrepresented in the Museum; the pelvic limb is shown in fig. 5. Two species have been named, viz.:—

Baptanodon natans, Marsh [1],
Baptanodon discus, Marsh [2],

both being from the Upper Jurassic of North America.

Fig. 5.



Baptanodon natans, Marsh.– Dorsal aspect of the left pelvic limb; from the Upper Jurassic of North America. Reduced. *T*, tibia; *i*, fibula; *F*, homologue of pisiform; *t*, tibiale; *c* (left side), intermedium; *c* (right), fibulare; *f*, postaxial bone of tarsus; the two bones immediately below the intermedium are the centralia. (*After Marsh*—from the 'Proc. Geol. Soc.')

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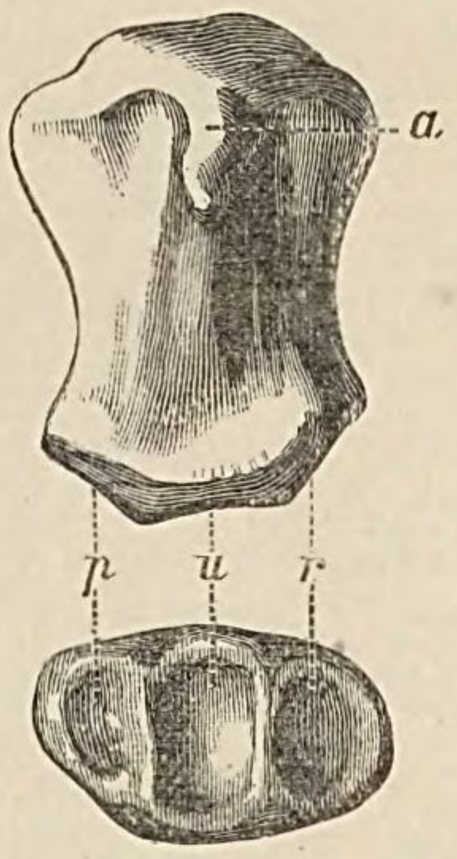
[1] Amer. Journ. ser. 3, vol. xvii. p. 86 (1879).—*Sauranodon.*
[2] *Ibid.* vol. xix. p. 491 (1880).

The three facets at the distal extremity of the humerus and femur are subequal; and it is possible that some of the English Cretaceous species presenting this character which are referred to *Ophthalmosaurus* may be referable to this genus.

Genus **OPHTHALMOSAURUS,** Seeley [1].

Teeth present, but apparently small, and perhaps confined to the anterior portions of the jaws. Humerus (fig. 6) and femur with strongly developed trochanteric ridge on dorsal surface, and articulating distally with three bones, as in *Baptanodon* (fig. 5), which are of irregular polygonal contour, the ulna being pentagonal. Clavicles (typically) separate, with the interclavicle wedged in between them.

Fig. 6.



Ophthalmosaurus cantabrigiensis.—Dorsal and distal aspects of the right humerus; from the Cambridge Greensand. ½. *a*, trochanteric ridge; *r*, facet for radius; *u*, do. for ulna; *p*, do. for pisiform.

Vertebral centra of the general type of those of the Campylodont subgroup of *Ichthyosaurus*. Coracoid without posterior notch. Humerus and femur apparently (except at the distal end) of the general type of those of *Ichthyosaurus campylodon*, and relatively large in proportion to the vertebræ. In *Baptanodon*, and probably also in this genus, both pectoral and pelvic (fig. 5) limbs relatively wide, containing six longitudinal rows of phalangeals, and the third digit (or that arising from the intermedium) contains two such rows, with the consequent presence of two centralia.

[1] Quart. Journ. Geol. Soc. vol. xxx. p. 696 (1874).

Ophthalmosaurus (?) cantabrigiensis, Lydekker [1].

Typically of small size. The three distal facets of the humerus nearly equal in size; and the antero-posterior diameter of the proximal extremity of the same bone exceeding that of the distal. This species may belong to *Baptanodon*.

Hab. Europe (England).

43989. The right humerus; from the Cambridge Greensand. (*Fig.*) The type specimen (woodcut, fig. 6). The general contour of this bone is very similar to that of the much larger humerus of *O. icenicus*, but the proximal extremity is larger than the distal, and the facet for the pisiform is nearly equal in size to that for the radius.

Purchased, 1872.

Some, or all, of the following specimens may be specifically distinct.

35348. The imperfect right humerus of a much larger individual; from the Cambridge Greensand. The radial portion of the distal surface is broken away; and the facet for the pisiform is double, as if for the articulation of a fourth bone.

Purchased, 1859.

35310. An imperfect bone, which is probably a humerus; from the Cambridge Greensand. The three distal facets, although somewhat worn, are distinctly visible. *Purchased*, 1859.

Ophthalmosaurus icenicus, Seeley [2].

The type species. Larger than the type of the preceding species, but the vertebræ considerably smaller than those of *Ichthyosaurus trigonus*. The postaxial facet on the distal extremity of the humerus smaller than that for the radius; and the antero-posterior diameter of the proximal extremity of the humerus less than that of the distal extremity. Vertebræ of the same general type as those of *Ichthyosaurus trigonus*, but relatively shorter, and in the cervical region with the cupping of the anterior face of the centrum confined to the central portion, and surrounded by a flattened periphery.

The type specimens are from the Oxford Clay (Middle Jurassic), and are figured in the 'Quart. Journ. Geol. Soc.' vol. xxx. pls. xlv., xlvi.

Hab. Europe (England).

[1] Geol. Mag. dec. 3, vol. v. p. 310 (1888).

[2] Quart. Journ. Geol. Soc. vol. xxx. p. 696 (1874).

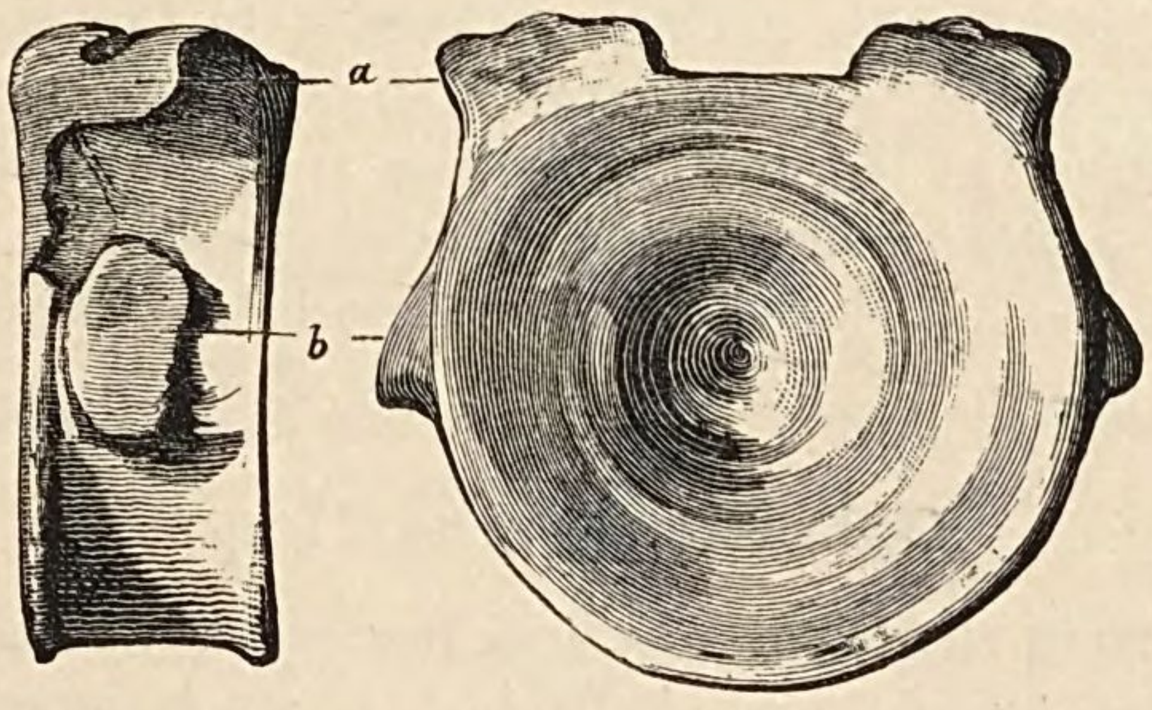
R. 1307. Casts of the centra of an associated early cervical, anterior or middle dorsal, and early caudal vertebra. The originals of these specimens belong to an imperfect skeleton from the Oxford Clay of Peterborough, Northamptonshire, in the Collection of A. N. Leeds, Esq., of Eyebury, near Peterborough. The dorsal is the 26th, and the caudal the 47th of the series. The dimensions of the dorsal are :—vertical diameter 0,082 (3·25 inches), transverse 0,089 (3·5 inches), length 0,035 (1·35 inches); and those of the caudal:—vertical diameter 0,080 (3·2 inches), transverse 0,078 (3·08 inches), length 0,027 (1·05 inches). The cervical is pentagonal and much narrowed inferiorly, and shows the cupping of the anterior face confined to the central region. In the later cervicals of the same skeleton the centrum becomes rounded inferiorly (as in fig. 7). The dorsal has both faces completely cupped, and a peculiar incurvation of the profile; in contour it appears indistinguishable from the specimen figured by Phillips in his 'Geology of Oxford,' p. 338, diagram 130, figs. 1, 2, as *Ichthyosaurus thyreospondylus*, but the relative length is somewhat greater; the dimensions of the later specimen being, transverse diameter 0,070 (2·75 inches), length 0,025 (1·0 inch). The dimensions of the humerus associated with the present specimens are :—length 0,145 (5·7 inches), width at distal extremity 0,124 (4·9 inches).

Made in the Museum, 1888.

46491. (*Fig.*) An associated series of twelve vertebral centra, apparently referable to this or a closely allied species; from the Kimeridge Clay of Foxhangers, near Devizes, Wiltshire. They comprise five posterior cervicals (one of which is represented in fig. 7), an anterior or middle dorsal, five later dorsals, and one posterior dorsal. The dorsals agree precisely with the dorsal of No. R. 1307; and the posterior dorsal narrows superiorly. In the cervicals (fig. 7) the cupping of the anterior face is shallow and confined to the middle area, and the contour of the inferior surface is rounded. In the figured specimen the vertical diameter is 0,066 and the transverse 0,074; the corresponding dimensions in the first of the five contiguous dorsals being 0,075 and 0,087. The upper costal facet in the cervicals is partly on the arch and partly on the centrum. *Cunnington Collection. Purchased*, 1875.

46473. The centrum of a middle dorsal vertebra, apparently specifically identical with the preceding; from the Kimeridge Clay of Foxhangers. *Cunnington Collection.*

Fig. 7.



(?) *Ophthalmosaurus icenicus.*—Left lateral and anterior aspects of a late cervical vertebra; from the Kimeridge Clay of Wiltshire. ½. *a*, upper; *b*, lower costal tubercle.

40407. A right coracoid not improbably belonging to this form; from the Kimeridge Clay (Upper Jurassic) of Ilminster, Somersetshire. This specimen, which is slightly imperfect, has a close resemblance to the coracoid of the type specimen figured by Seeley. It apparently indicates, however, that the borders of the latter are incorrectly determined, the one marked intercoracoidal being really the glenoid cavity. This specimen differs considerably from the coracoids mentioned under the head of *Ichthyosaurus trigonus.* *Presented by Sir R. Owen, K.C.B.*

47885. A left humerus, indistinguishable from the corresponding bone of the opposite side of the type specimen; from the Kimeridge (?) Clay in the neighbourhood of Oxford. The dimensions of this specimen are identical with those of the humerus of the type; the length being 0,170 (6·5 inches), and the width of the distal extremity 0,145 (5·5 inches). The three distal facets are clearly shown.
Presented by the Hon. R. Marsham, 1877.

46474. A crushed right humerus, not improbably belonging to a larger individual of the same species as the preceding specimen; from the Kimeridge (?) Clay of (probably) Wiltshire. The three distal faccts are well preserved.
Cunnington Collection.

48000. Eight associated bones of the pectoral limb; from the Oxford Clay, near Oxford. These specimens comprise the radius and ulna and five other bones. The radius and ulna closely resemble those of the type specimen, but are rather smaller. *Presented by the Hon. R. Marsham*, 1877.

R. 472. A right femur, probably belonging to this species; from the Oxford Clay of Stanground, near Peterborough. The contour of the proximal portion is of the type of the corresponding bone of *Ichthyosaurus campylodon*. The facet for the homologue of the pisiform is broken away [1].
Presented by Sir R. Owen, K.C.B., 1884.

Ophthalmosaurus (**?**), sp.

The following specimen, which is provisionally referred to the present genus, indicates an individual of much larger size than either of the above-mentioned Cretaceous specimens.

Hab. Europe (England).

R. 1192. The imperfect right dentary bone of a very large Ichthyopterygian; from the Upper Greensand of Warminster, Wiltshire. A series of small dental alveoli are seen at the anterior extremity, but there are none posteriorly, although there is a dental groove; the specimen therefore accords with Baur's description of the jaw of *Ophthalmosaurus*.
No history.

Genus **ICHTHYOSAURUS,** Conybeare (*ex* König [2], MS.).

Syn. *Proteosaurus*, Home [3].
Gryphus, Wagler [4].

Teeth generally large and extending throughout the jaws. Humerus (fig. 9) and femur with or without strongly-marked trochanteric ridge; and normally with two distal facets for the respective articulation of the short radius and ulna and tibia and fibula, which bones are respectively in close apposition to one another, and are of more or less quadrangular outline, the radius being either transversely elongated or nearly square. Clavicles mesially united by anchylosis or squamous overlap, with the transverse portion of the interclavicle resting upon the ventral aspect.

[1] See p. 5.
[2] Trans. Geol. Soc. ser. 1, vol. v. pt. 2, p. 563 (1821).
[3] Phil. Trans. 1819, p. 212.—This name has the priority; see Introduction.
[4] Syst. Amphib. p. 60 (1830).

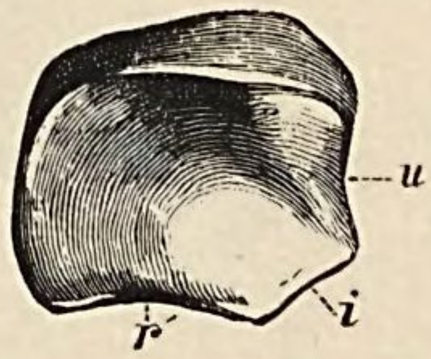
Occasionally, as in the case of *I. tenuirostris*, mentioned on p. 85, there are three distal facets on the proximal limb-bone; but the third is clearly formed by the upthrusting of the intermedium, and is, therefore, if Baur's interpretation be correct, not homologous with the third facet of *Ophthalmosaurus*.

It has been suggested that this genus should be subdivided into two or more genera; and if this view be adopted, the two under-mentioned groups should form distinct genera, although there are signs of a transition from the one to the other. It would, however, be difficult to know when to stop if generic divisions were made; and it therefore appears to the author to be more convenient, both for the palæontologist and geologist, to retain for the present the genus in its original wide sense.

A. Latipinnate Group[1].

Orbit of moderate size. Teeth with fluted, cylindrical crowns, and their roots either invested with a smooth coat of cement, or fluted in a coarser manner than the crowns. Pectoral limb (figs. 20, 22, 24) with the third digit, or that arising from the intermedium, comprising two longitudinal rows of bones, and consequently two centralia (fig. 24); not less than five longitudinal rows of phalangeals in this limb; and the radius (fig. 8) transversely elongated

Fig. 8.



Ichthyosaurus intermedius.—Dorsal aspect of left radius; from the Lower Lias of Street. ½. *u*, facet for ulna; *i*, do. for intermedium; *r'*, do. for radiale.

and its anterior border entire. Never any trace of a vacuity between the radius and ulna. Pectoral limb much larger than pelvic (fig. 20). Neural spines of dorsal vertebræ usually tall and narrow.

This group comprises the more specialized forms, and includes the type species. Its range in time extends from the Lias to the Chalk.

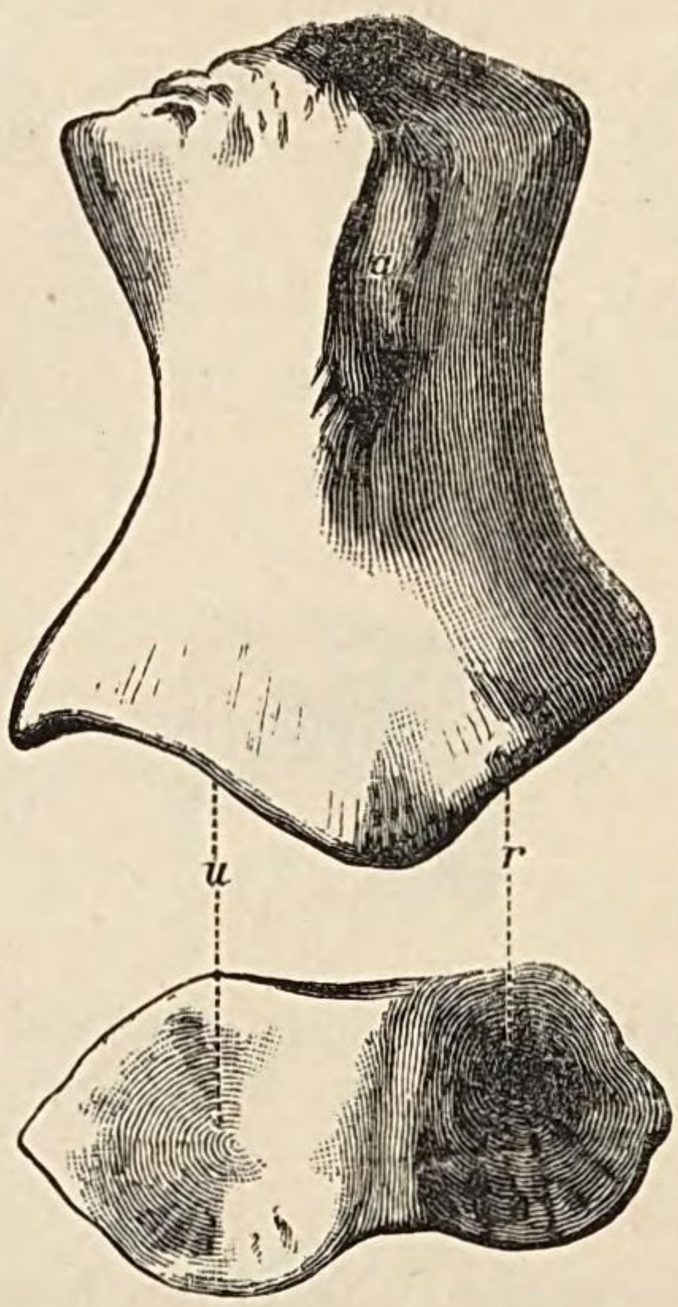
[1] Kiprijanoff, Mém. Ac. Imp. St. Pétersbourg, vol. xxviii. art. 8, p. 88 (1881). The term *pinnate* has been substituted for *pinnipedine* in this and the next group.

In the Cretaceous and Kimeridgian species the entire paddle is unknown, and its structure can only be inferred from the correspondence of its radius with that of the Liassic forms, and of the humerus with that of *Ophthalmosaurus*. If it should be found that any of the species differ in the arrangement of the digits of the paddle from the typical subgroup, the structure of the radius will have to be made the primary distinctive character of the Lati- and Longipinnate groups.

a. *Campylodont Subgroup*.

The roots of the teeth (fig. 11) enveloped in a thick layer of cement, which generally assumes a more or less bulbous form, and may be angulated. Coracoid (when known) without posterior notch; scapula (when known) with prominent ridge on anterior border of dorsal surface of proximal extremity. Humerus (fig. 9) and femur

Fig. 9.



Ichthyosaurus (*cf.*) *trigonus*.—Dorsal and distal aspects of the right humerus; from the Kimeridge Clay of the Isle of Portland. ⅓. *a*, trochanteric ridge; *r*, radial, *u*, ulnar facet.

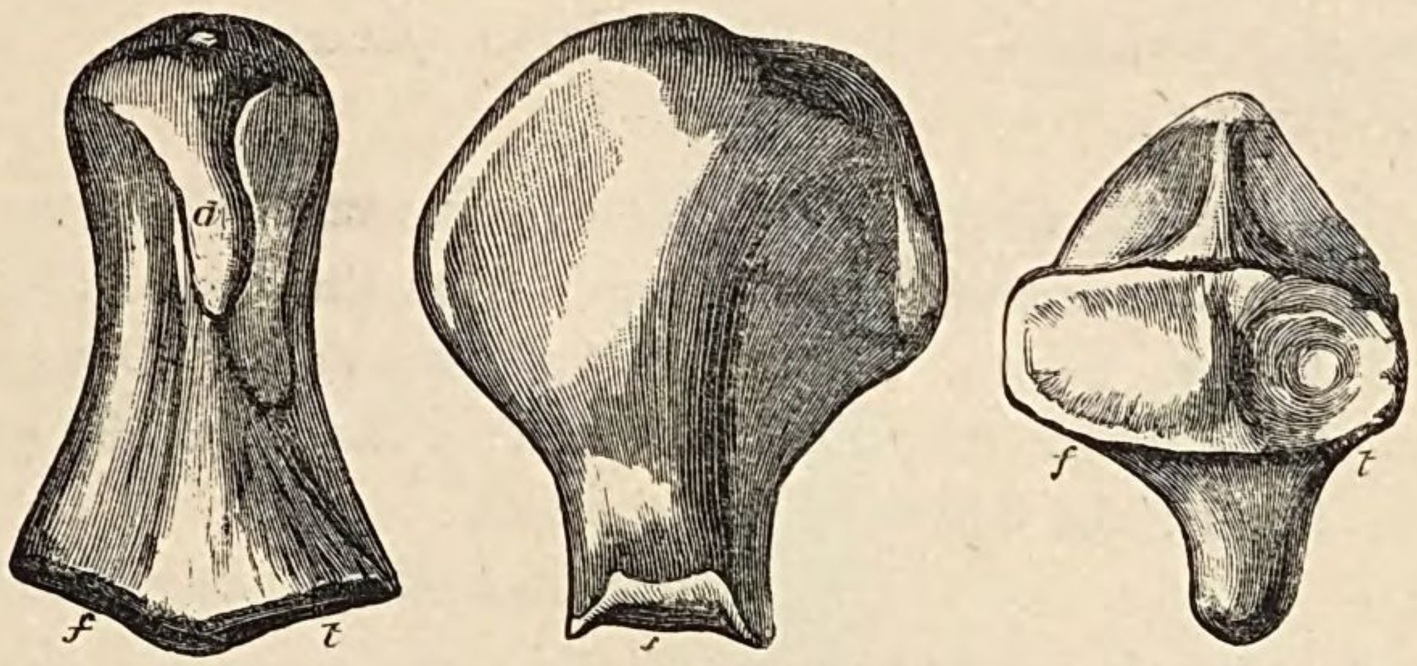
with strongly developed trochanteric ridges. Cervical and anterior dorsal vertebræ with pentagonal, subcordiform centra (fig. 7); and the superior costal articulation of the former in great part or entirely on the neural arch (fig. 7); late posterior dorsal and anterior caudal centra narrowed superiorly.

This subgroup includes the most specialized forms, and those nearly related to *Ophthalmosaurus*.

Ichthyosaurus campylodon, Carter [1].

Of very large dimensions. Skull stout, with elongated rostrum. Teeth (fig. 11) very large and closely approximated, with the crowns slightly curved and very coarsely fluted. Centra of vertebræ of moderate length, with the cupping of the terminal faces moderately deep, and a distinct deeper pit in the centre of the anterior face. Femur (fig. 10) very short, with its trochanteric and

Fig. 10.



Ichthyosaurus campylodon.—Dorsal, postaxial, and distal aspects of the right femur; from the Cretaceous (? Gault) of Russia. ½. *a*, trochanteric ridge; *t*, tibial, *f*, fibular facet. (*After Kiprijanoff.*)

opposite ridges enormously developed, so as to make the lateral surfaces of the proximal portion wider than the dorsal.

This species was originally described from the Lower Chalk of Cambridgeshire on the evidence of jaws and teeth. Teeth of similar type are found from the Upper Chalk to the Gault, and in the absence of any evidence to the contrary are referred to the same species, although it is quite probable that they may belong to more than one species. The specimens of humerus and femur (fig. 10) associated with teeth of this type from the Cretaceous of Russia, figured by Kiprijanoff [2], show the two distal facets characteristic of *Ichthyosaurus*, and have a strongly developed trochanteric ridge. An associated radius, figured by the same writer [3], closely resembles fig. 8, having the entire anterior border and transversely elongated contour characteristic of the present group; while an ulna [4] attached to one specimen of the humerus is also of the characteristic sub-

[1] Rep. Brit. Assoc. for 1845,—Trans. of Sections, p. 60 (1846).
[2] Mém. Ac. Imp. St. Pétersbourg, vol. xxviii. art. 8, pls. xiv., xv. (1881).
[3] *Ibid.* pl. xiv. fig. 3. [4] *Ibid.* fig. 1.

quadrangular type. Similar humeri are also found in association with teeth referred to this species in the Gault of France[1]. The cervical and anterior dorsal vertebræ from the Russian Cretaceous, figured by Kiprijanoff[2], have the pentagonal and subcordiform terminal faces characteristic of *I. trigonus*; the contour of the later vertebræ also resembling that obtaining in the same species. In the Cambridge Greensand humeri and femora of the above-mentioned type occur, together with those of *Ophthalmosaurus*. The Russian specimens are from beds probably equivalent to the Gault.

I. strombecki, Meyer[3], from the Lower Greensand of North Germany, is provisionally regarded by Kiprijanoff[4] as founded upon young teeth of the present species, but it is very probably distinct; and both that form and *I. polyptychodon*, Koken[5], from the same deposits, may be allied to the Kimeridgian species.

Hab. Europe.

32810. (*Fig.*) Part of the dentary bone of the left ramus of the mandible, containing eight entire teeth; from the Lower Chalk near Dover, Kent. Described and figured by Owen in his 'Cretaceous Reptilia' (Mon. Pal. Soc.), p. 69, pl. xxiii. fig. 1; the figure being reversed.

Taylor Collection. Purchased, 1854.

32811. (*Fig.*) Part of the right ramus of the same mandible, containing part of the splenial and part of the dentary, and exhibiting several displaced teeth, of which two are entire; from the same locality. Described and figured by Owen, *op. cit.* p. 70, pl. xxiii. fig. 2; the figure being reversed.

Taylor Collection.

32812. (*Fig.*) The anterior extremity of the right ramus of the same mandible. Described and figured by Owen, *op. cit.* p. 71, pl. xxiii. fig. 3; the figure being reversed.

Taylor Collection.

41895. The broken anterior portion of the rostrum of the skull; from the Chalk-Marl of Trumpington, near Cambridge. The extremity is nearly entire, although almost all the teeth are broken. *Purchased*, 1869.

R. 13. Fragment of the rostrum, exhibiting several teeth in position, and a transverse section; from the Lower Chalk at Dover. The transverse section is similar to the one figured by

[1] Sauvage, Mém. Soc. Géol. France, sér. 3, vol. ii. art. 4, pl. xxxii. figs. 6, 7 (1882).
[2] *Op. cit.* pl. xi.
[3] Palæontographica, vol. x. art. 2, p. 83 (1862).
[4] *Op. cit.*
[5] Zeitschr. deutsch. geol. Ges. vol. xxxv. p. 737 (1883).

Owen, *op. cit.* pl. xxvi. fig. 2, with the exception that, owing to the more anterior position of the plane of section, the nasals have entirely disappeared. Other fragments are associated with this specimen.

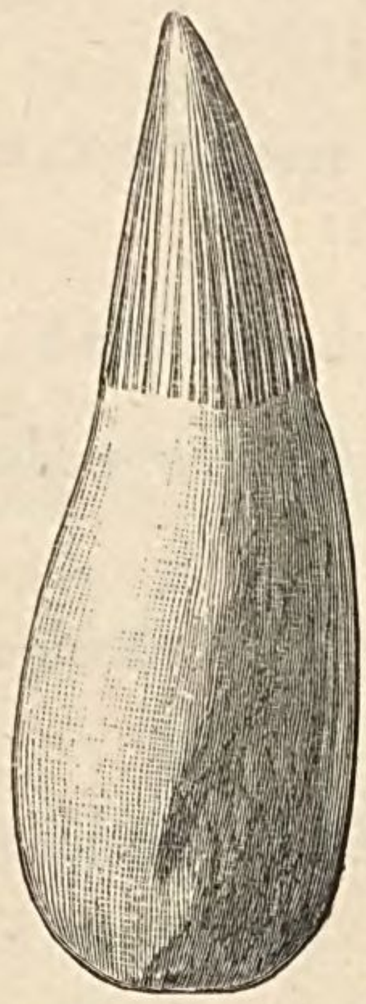
Gardner Collection. Purchased, 1879.

47235. Several teeth, in matrix; from the Gault of Folkestone.

Gardner Collection. Purchased, 1876.

49911. An associated series of twelve teeth (some imperfect) and (*Fig.*) two centra (one imperfect) of dorsal vertebræ; from the

Fig. 11.



Ichthyosaurus campylodon.—Profile view of a tooth; from the Lower Chalk of Folkestone. $\frac{1}{1}$.

Lower Chalk of Folkestone, Kent. One of the teeth (marked *x*) is figured in the accompanying woodcut. The vertebral centra have a transverse diameter of 0,100.

Purchased, 1879.

32824, 32827, 32828, 32829, 32830. Five teeth; from the Lower Chalk near Dover. Probably associated with No. 32810.

Taylor Collection.

R. 49. Fragment of rostrum showing six teeth, with one surface (*Fig.*) of the root exposed; from the Lower Chalk of Lydden-Spout, near Folkestone. Described and figured in Dixon's 'Geology of Sussex,' p. 400, pl. xxxix. fig. 10.

Purchased, 1881.

R. 49 a. Two teeth, in matrix; from the Lower Chalk of Dover.

No history.

32825. A tooth ; from the Lower Chalk of (?) Dover.
Taylor Collection.

33294. Several teeth ; from the Chalk of Isleham, Cambridgeshire.
Dixon Collection. Purchased, 1851.

47233. A series of teeth from the Lower (Grey) Chalk of Dover.
Gardner Collection. Purchased, 1876.

35252–4. A series of teeth ; from the Cambridge Greensand.
Purchased, 1859.

47265. A series of associated teeth ; from the Cambridge Greensand. These specimens belong to the same individual as the vertebræ No. 47266. *Gardner Collection.*

30253–4–5. Several teeth ; from the Cambridge Greensand.
Purchased, 1855.

33242. Three teeth ; from the Cambridge Greensand. *Purchased.*

35434. Three teeth ; from the Cambridge Greensand.
Purchased, 1859.

40358. Three teeth ; from the Cambridge Greensand.
Purchased, 1867.

41896. Two teeth ; from the Chloritic Marl of Trumpington, near Cambridge. *Purchased*, 1869.

32406. Five teeth specifically indistinguishable from the preceding ; from the Upper Greensand of Kilmenton, Somersetshire.
Purchased.

40095. A large tooth of similar type in matrix ; from the Upper Greensand of Charmouth, Dorsetshire. *Purchased.*

46381. Two imperfect teeth in matrix ; from the Upper Greensand of Warminster, Wiltshire.
Cunnington Collection. Purchased, 1875.

47269. Three teeth in matrix, agreeing with typical specimens ; from the Upper Greensand of Folkestone.
Gardner Collection. Purchased, 1876.

47235 a. Six teeth of similar type in matrix ; from the Gault of Folkestone. *Gardner Collection. Purchased*, 1876.

R. 16. Two teeth in matrix, one wanting the root ; from the Gault of Folkestone. *Gardner Collection. Purchased*, 1879.

R. 16 a. Six associated much smaller teeth in matrix; probably belonging to a young individual of this species; from the Gault of Folkestone. *Gardner Collection.*

47270. Fragment of jaw containing one tooth; from the Gault of Folkestone. *Gardner Collection.*

36318. A large tooth in matrix; from the Gault of Folkestone. *Purchased*, 1862.

36384. An imperfect large tooth in matrix; from the Gault of Folkestone. *Purchased*, 1862.

33245. Several teeth, mostly imperfect; from the Cretaceous of Kursk, Russia. Similar teeth are figured by Kiprijanoff in the 'Mém. Ac. Imp. St. Pétersbourg,' vol. xxviii. art. 8, pls. i., ii. (1881). *Presented by Col. Kiprijanoff.*

40558. An imperfect left femur of a very large individual; from the Cambridge Greensand of Wadden, near Cambridge. This specimen has been longitudinally split, and at the distal extremity only the tibial facet remains entire, which has a transverse diameter of 0,071. This bone resembles the smaller Russian examples figured by Kiprijanoff in the 'Mém. Ac. Imp. St. Pétersbourg,' vol. xxviii. art. 8, pl. xv. (1881); one of which is reproduced in woodcut fig. 10, p. 15. The very large size and shortness of this bone probably indicates that the pelvic paddle agreed closely in size and structure with the pectoral, as seems to have been the case with *Ophthalmosaurus*. *Purchased*, 1867.

35272. An imperfect femur of a considerably smaller individual; from the Cambridge Greensand. The two distal facets are entire and well preserved. *Purchased*, 1859.

35311. A still smaller femur, in a water-worn condition; from the Cambridge Greensand. The two facets at the distal extremity are clearly shown. *Purchased*, 1859.

35321. A series of associated bones of the paddle; from the Cambridge Greensand. These and other similar specimens in the Woodwardian Museum at Cambridge apparently indicate that the anterior border of the radius and tibia was entire. The phalangeals are of the quadrangular form characteristic of the Latipinnate group, and are quite different from the corresponding bones of *Baptanodon*, so that it

is probable that this specimen belongs to *I. campylodon* or an allied species. *Purchased*, 1859.

Some of the following specimens may belong to Ophthalmosaurus.

35323. The basioccipital of a very large individual; from the Cambridge Greensand. The transverse diameter is 0,115. *Purchased*, 1859.

44159. A smaller basioccipital; from the Cambridge Greensand. *Purchased*, 1873.

44159 a. A slightly smaller basioccipital; from the Cambridge Greensand. *Purchased*, 1873.

35301. A very similar basioccipital; from the Cambridge Greensand. *Purchased*, 1859.

35390. A basisphenoid, agreeing in size with the preceding specimen; from the Cambridge Greensand. *Purchased*, 1860.

35323. The quadrate of a very large individual; from the Cambridge Greensand. *Purchased*, 1859.

35272. The associated quadrates of a smaller individual; from the Cambridge Greensand. *Purchased*, 1858.

35415. The conjoint atlas and axis vertebræ of a comparatively large individual; from the Cambridge Greensand. *Purchased*, 1860.

35302. A smaller example of the same elements; from the Cambridge Greensand. *Purchased*, 1859.

35431. A very similar specimen in a rolled condition; from the Cambridge Greensand. *Purchased*, 1859.

35345. A rather smaller specimen of the same bone; from the Cambridge Greensand. *Purchased*, 1859.

39256. The slightly imperfect conjoint atlas and axis vertebræ; from the Gault of Folkestone. This specimen agrees very closely with No. 35302. *Purchased*, 1865.

47275. A considerably smaller and more imperfect example of the corresponding bone; from the Folkestone Gault. *Gardner Collection.* *Purchased*, 1876.

32814. (*Fig.*) One half of the centrum of a dorsal vertebra of a large individual; from the Lower Chalk near Dover. Figured by

Owen in his 'Cretaceous Reptilia' (Mon. Pal. Soc.), pl. xxii. This specimen was associated with the mandible No. 32810.
Taylor Collection.

47266. A series of twenty-four associated trunk vertebral centra, of large size, and mostly imperfect; from the Cambridge Greensand. These specimens belong to the same individual as the teeth No. 47265. *Gardner Collection.*

35303. The imperfect centrum of a large dorsal vertebra; from the Cambridge Greensand. *Purchased*, 1859.

35312. An associated series of eight smaller vertebral centra; from the Cambridge Greensand. *Purchased*, 1859.

35303 a. The centra of two smaller dorsal vertebræ; from the Cambridge Greensand. *Purchased*, 1859.

35346. The nearly perfect centrum of a small trunk vertebra; from the Cambridge Greensand. *Purchased*, 1859.

47270. The centra of two small dorsal vertebræ; from the Gault of Folkestone. The central pit on the anterior face is very distinct. *Gardner Collection.*

R. 15. The centrum of a larger trunk vertebra; from the Folkestone Gault. *Gardner Collection.*

33059. The centrum of a large trunk vertebra; from the Folkestone Gault. *Purchased*, 1858.

33244. The centrum of a very large trunk vertebra; from the Cretaceous of Kursk, Russia. The transverse diameter is 0,130. *Presented by Col. Kiprijanoff.*

The following specimen may perhaps indicate a distinct species.

R. 1308. The imperfect centrum of a dorsal vertebra; from the Cambridge Greensand. This specimen is remarkable for the extreme flatness of the greater part of the terminal faces, the cupping being confined to a deep central pit. In this respect it agrees with the larger specimen from the Russian Cretaceous figured by Kiprijanoff in the 'Mém. Ac. Imp. St. Pétersbourg,' vol. xxxi. art. 6, pl. viii., as *Polyptychodon*, but subsequently referred to *I. latimanus* (*vide infrà*, pp. 53, 54).
Presented by R. Lydekker, Esq., 1888.

Ichthyosaurus indicus, Lydekker[1].

Known only by a few vertebral centra; probably closely allied to, if not identical with, the preceding species.

Hab. India (Madras).

R. 307. An imperfect vertebral centrum of a large individual, provisionally referred to this species; from the Upper Cretaceous of Madras. This specimen has been much injured by weathering, and one surface has been cut and polished.
By exchange.

Ichthyosaurus trigonus, Owen[2].

Syn. (?) *Ichthyosaurus posthumus*, Wagner[3].
(?) *Ichthyosaurus cuvieri*, Valenciennes[4].
(?) *Ichthyosaurus normanniæ*, Valenciennes[5].

Of very large dimensions, but imperfectly known. Teeth of the Campylodont type, the undermentioned specimens having their crowns more conical and the flutings of the enamel finer than in *I. campylodon*. Centra of vertebræ comparatively long, with the cupping of the terminal faces very deep, and in the cervical region occupying the whole of these faces. In the dorsals the centra are of moderate breadth; the vertical diameter in the middle part of the series not exceeding the transverse.

This species was founded upon vertebræ from the Kimeridge Clay, which are not now forthcoming; and it will be convenient to regard those figured by Phillips in his 'Geology of Oxford' as representing the types. *I. cuvieri* was founded upon a skull from the Kimeridgian of Boulogne, having teeth of the Campylodont type, which is figured by Lennier in his 'Etudes géologiques et paléontologiques sur l'Embrasure de la Seine' (Havre, 1870), pl. vi.; while *I. normanniæ* was based on a basioccipital, basisphenoid, and vertebræ, obtained at the same time from the same spot, and figured by Lennier in the plate cited. As stated by that writer, it is almost certain that all these remains belonged to the same individual; and it is probable that the species in question is identical with *I. trigonus*.

There is no decisive evidence that this species belongs to *Ichthyo-*

[1] Palæontologia Indica (Mem. Geol. Surv. Ind.), ser. 4, vol. i. pt. 3, p. 28 (1879).
[2] Rep. Brit. Assoc. for 1839, p. 124 (1840).
[3] Abh. k. bay. Ak. Wiss. vol. vi. pt. 2, p. 702 (1851).
[4] Comptes Rendus, vol. liii. p. 273 (1861).
[5] *Ibid.* p. 1001.

saurus rather than to *Ophthalmosaurus*; but the skull and teeth of the so-called *I. cuvieri* are of the Campylodont type, and since propodial bones occur in the Kimeridgian which would agree in relative size with the vertebræ of the present form, and are themselves clearly referable to *Ichthyosaurus*, there is a considerable probability that the present species belongs to that genus. This species was, indeed, provisionally referred by Kiprijanoff[1] to the Campylodont subgroup.

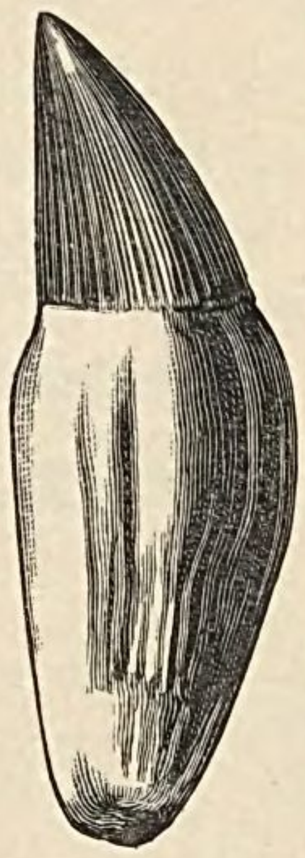
The specimens of scapulæ from the Kimeridgian, some of which are probably referable to the present form, have a long and comparatively straight posterior border, with a marked ridge on the anterior border of the dorsal surface, and resemble the corresponding bone of *I. platyodon*.

I. posthumus was founded upon Campylodont teeth from the Lower Kimeridgian of Bavaria.

Hab. Europe (England, (?) France, and (?) Bavaria).

24803. Four teeth of the Campylodont type, not improbably belonging to this species; from the Kimeridge Clay (Upper Jurassic) of Wootton-Bassett, Wiltshire. These teeth are of the general structure of those of *I. campylodon*, and one of them exhibits the flutings of the dentine of the root beneath the investment of cement. They are indistinguishable from the type tooth of *I. posthumus*, figured by Wagner in the 'Abh. k. bay. Ak.' vol. vi. pt. 2, pl. xx. figs. 4, 5. *Cunnington Collection.* *Purchased*, 1849.

Fig. 12.



Ichthyosaurus (*cf.*) *trigonus*.—Lateral aspect of a tooth; from the Kimeridge Clay of Shotover. $\frac{1}{1}$.

[1] Mém. Ac. Imp. St. Pétersbourg, vol. xxviii. art. 8, p. 90 (1881).

R. 270. (*Fig.*) An entire tooth of similar type; from the Kimeridge Clay of Shotover, Oxfordshire. This tooth (fig. 12) may have been associated with the vertebra No. R. 271, with which it agrees in mineral condition.

Egerton Collection. Purchased, 1882.

11265. The conjoint atlas and axis vertebræ of a comparatively large individual; from the Kimeridge Clay, locality unknown. This specimen may belong either to this or to one of the following forms. *Mantell Collection. Purchased*, 1838.

47327. The centrum of an anterior cervical vertebra; from the Kimeridge Clay of Swindon, Wiltshire. This specimen agrees precisely, both in size and proportions, with the vertebra (which may be taken as the type) figured by Phillips in his 'Geology of Oxford,' p. 335. The vertical diameter of the anterior face is 0,081, the transverse 0,076, and the length 0,041. The upper costal articulation is partly confluent with the neural facet, and both faces are equally cupped.

Presented by the Directors of the Swindon Brick and Tile Company, 1873.

47327 a. The centrum of a somewhat later cervical vertebra, associated with the preceding. *Same history.*

24684. The centrum of an anterior dorsal vertebra; from the Kimeridge Clay of Wootton-Bassett. This specimen accords in relative length with the somewhat later centrum figured by Phillips, *op. cit.* p. 336.

Cunnington Collection. Purchased, 1849.

R. 1305. A very similar centrum; from the Kimeridge Clay, locality unknown. *No history.*

R. 271. The centrum of a smaller anterior dorsal vertebra; from the Kimeridge Clay of Shotover. Vertical diameter 0,078 (3·1 inches), transverse 0,084 (3·3 inches), length 0,038 (1·5 inches). *Egerton Collection.*

24684 a. The centra of one anterior and two middle dorsal vertebræ of rather smaller dimensions, provisionally referred to this species; from Wootton-Bassett. The length is unusually great. *Cunnington Collection. Purchased*, 1849.

24684 b. The centrum of a medium-sized middle dorsal vertebra; from the Kimeridge Clay of Wootton-Bassett. The ter-

minal faces are nearly circular. Although of rather smaller dimensions this specimen accords closely in serial position and proportions with the one figured by Phillips, *op. cit.* p. 336, diagram cxxvii. fig. 3. The vertical diameter is 0,084, the transverse 0,084, and the length 0,040.

Cunnington Collection.

41776. The imperfect centrum of a larger middle dorsal vertebra; from the Kimeridge Clay of Weymouth, Dorsetshire.

Purchased, 1869.

41776 d. The centrum of a rather smaller middle dorsal vertebra; from the Kimeridge Clay of Weymouth. *Purchased*, 1869.

44599. A water-worn centrum of a very similar dorsal vertebra; from the Kimeridge Clay of Swindon.

Presented by the Directors of the Swindon Brick and Tile Company, 1873.

47506. The centrum of a rather later dorsal vertebra, of considerable size; from the Kimeridge Clay of Kimeridge Bay, Dorsetshire.

Presented by J. C. Mansel-Pleydell, Esq., 1876.

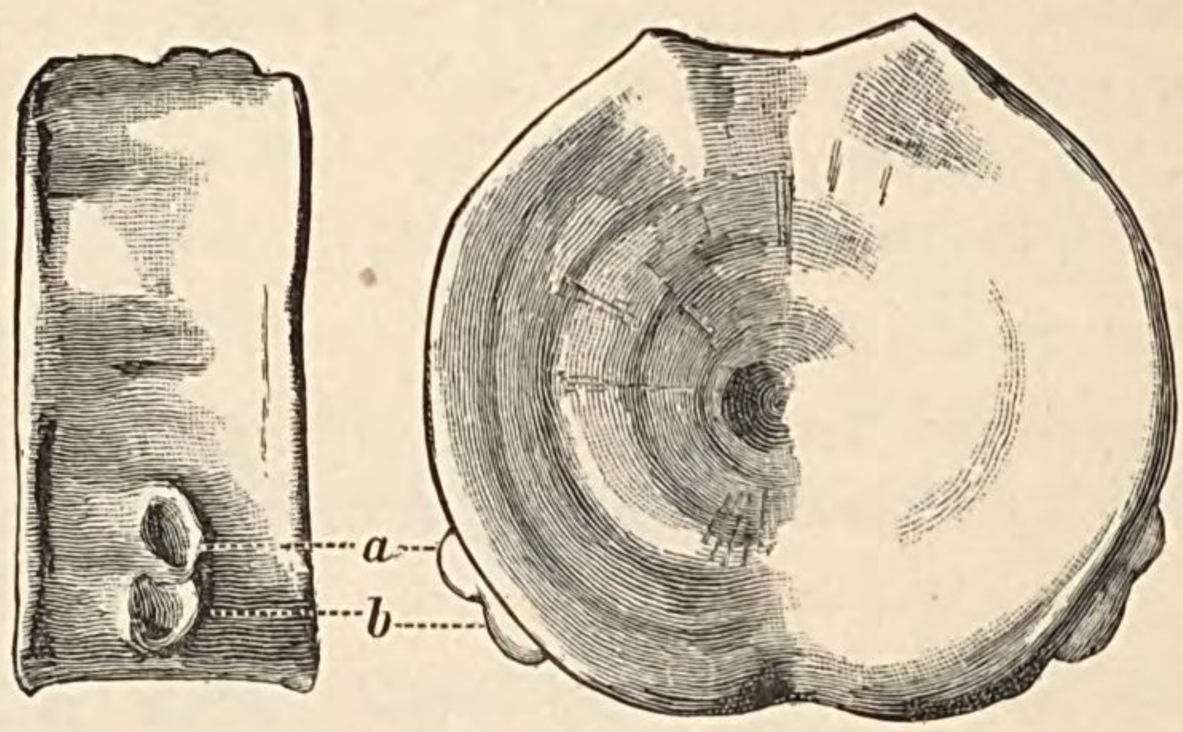
24684 c. A centrum agreeing in size with the preceding, but rather later in the series, and of relatively greater length; from the Kimeridge Clay of Wootton-Bassett.

Cunnington Collection. Purchased, 1849.

R. 271. The centrum of a middle dorsal vertebra of smaller size; from the Kimeridge Clay. *Egerton Collection.*

R. 9. (*Fig.*) The centrum of an early posterior dorsal vertebra probably belonging to this species; from the Kimeridge Clay of Stanton, near Bury-St.-Edmunds, Suffolk. In this specimen (fig. 13) the terminal faces are elongated transversely, and not narrowed superiorly; the vertical diameter being 0,111 (4·0 inches), and the transverse 0,128 (5·0 inches). The costal tubercles are placed low and have nearly coalesced. The difference in the contour of this specimen compared with the next is parallelled in the vertebral column of *I. platyodon*, No. 481 (p. 101), where the centra marked 26 and 27 are of the contour of the present specimen, while that marked 33 is of the type of the next specimen. In the present specimen, however, the costal tubercles have descended lower than in the corresponding vertebræ

Fig. 13.

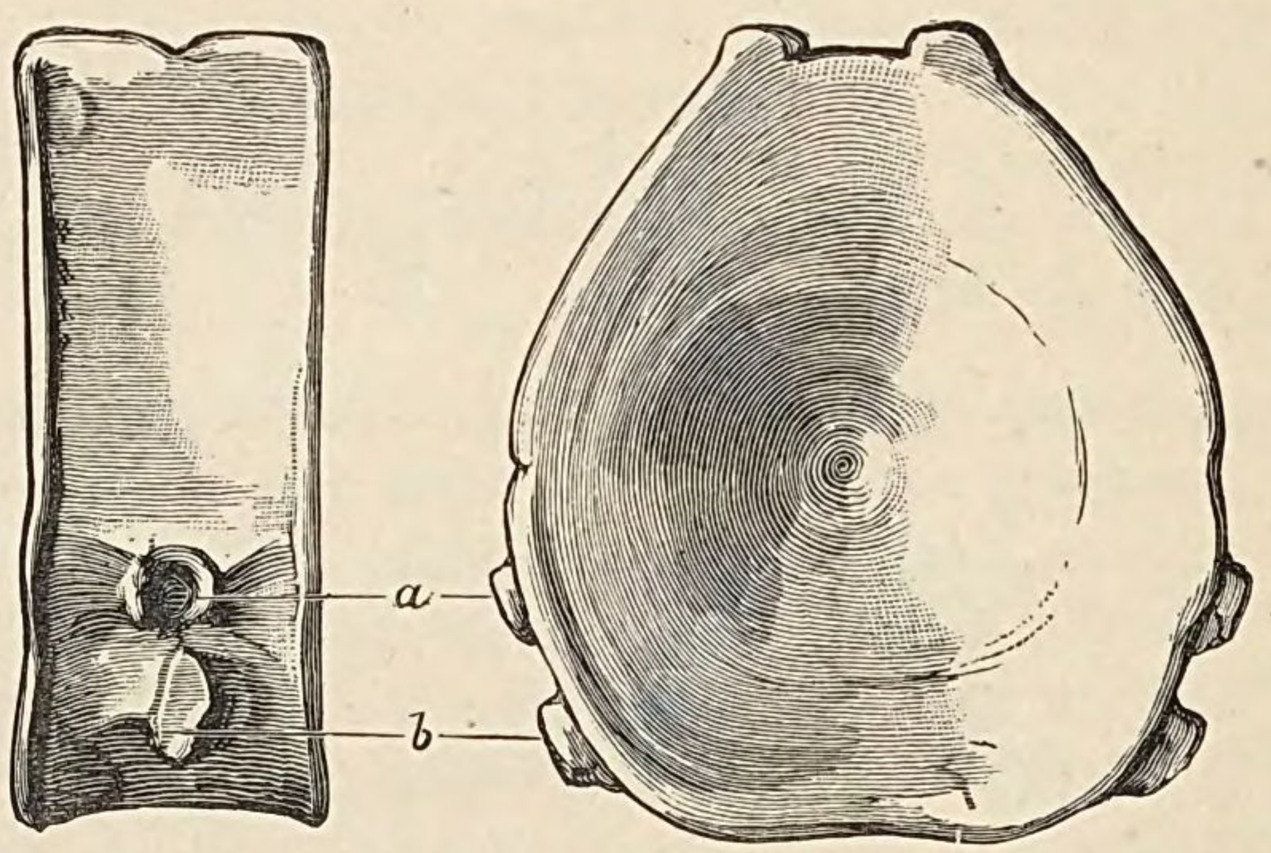


Ichthyosaurus trigonus.—Left lateral and anterior aspects of the centrum of an early posterior dorsal vertebra; from the Kimeridge Clay of Stanton. ⅓. *a*, upper, *b*, lower costal tubercle.

of *I. platyodon*. The variations in the relations of the costal tubercles are noticed in the above-mentioned vertebral column of the latter species. *Purchased*, 1880.

24684 d. (*Fig.*) The centrum of a large late posterior dorsal vertebra; from the Kimeridge Clay of Wootton-Bassett. This specimen (fig. 14) agrees with Phillips's description (*op. cit.* p. 336) of the 40th vertebra; the outline of the face narrowing upwards, and the height being nearly equal to the width. The length of Phillips's specimen is, however, said to be greater. *Cunnington Collection.*

Fig. 14.



Ichthyosaurus trigonus.—Left lateral and anterior aspects of the centrum of a late posterior dorsal vertebra; from the Kimeridge Clay of Wootton-Bassett. ⅓. *a*, upper, *b*, lower costal tubercle.

46473 a. A smaller centrum of a posterior dorsal vertebra, agreeing in characters with the preceding; from the Kimeridge Clay of Foxhangers, near Devizes, Wiltshire.
Cunnington Collection. Purchased, 1875.

41776 a. Two associated centra of posterior dorsal vertebræ; from the Kimeridge Clay of Weymouth. These specimens agree with the last, but their contour is somewhat altered by crushing. *Purchased.*

20285. The centrum of a caudal vertebra; from the Kimeridge Clay of Ely, Cambridgeshire. Vertical diameter 0,093 (3·65 inches), transverse 0,091 (3·58 inches), length 0,038 (1·5 inches). *Purchased.*

24684 e. The centrum of a large anterior caudal vertebra, apparently associated with No 24684 *d*. This specimen agrees with Phillips's description of the 50th vertebra, but the length is less. *Cunnington Collection. Purchased*, 1849.

24684 f. A rather later caudal centrum, probably associated with the preceding. The costal articulation has here become circular. *Cunnington Collection.*

41801. The centrum of a smaller anterior caudal vertebra, specifically indistinguishable from the preceding; from the Kimeridge Clay of Ely. This speeimen agrees very closely in all respects with the one figured by Phillips, *op. cit.* p. 337, diagram cxxviii. figs. 1, 2. *Purchased*, 1869.

41776 b. A rather later caudal vertebra; from the Kimeridge Clay of Weymouth. *Purchased*, 1869.

R. 1341. A very similar centrum; from the Kimeridge Clay of Shotover. The reference of this and the following specimen is provisional. *No history.*

46473 b. A smaller caudal centrum of similar type; from the Kimeridge Clay of Foxhangers. *Purchased*, 1875.

24684 g. A caudal centrum, associated with the dorsals, No. 24684 *a*. This specimen is considerably larger than either of the preceding. *Purchased*, 1849.

It is probable that some of the following specimens belong to this species.

41958. A left coracoid; from the Kimeridge Clay of Weymouth. There is no posterior notch, and the specimen differs

widely from the coracoid of *Ophthalmosaurus*. It is indistinguishable from the coracoids figured by Phillips in his 'Geology of Oxford,' p. 340, diagram cxxxiii. fig. 1.
Purchased, 1870.

42287. A smaller and much crushed coracoid of similar general type; from the Kimeridge Clay of the Isle of Portland.
Purchased, 1869.

42284. The imperfect and crushed left humerus of a large individual; from the Kimeridge Clay of the Isle of Portland. The characters of this specimen appear to be very similar to those of the humerus figured by Phillips, *op. cit.* p. 340. The two distal facets are very distinct. Contrasted with the humerus of *Ophthalmosaurus icenicus* (No. 47785, p. 11), this specimen differs not only in the number of distal facets, but also in its narrower form and less expanded extremities. It is highly probable that this specimen belongs to the present species. *Purchased*, 1869.

42286. (*Fig.*) A somewhat smaller and slightly imperfect right humerus, which may or may not be specifically identical with the preceding; from the Kimeridge Clay of the Isle of Portland. The distal extremity (fig. 9, p. 14) is entire, but the radial angle of the proximal end has been broken away. The contour, which in the preceding specimen has been lost by crushing, is perfectly preserved. *Purchased*, 1869.

42285. A slightly imperfect right humerus agreeing in size with the preceding specimen, but apparently indicating a different species; from the Kimeridge Clay of the Isle of Portland. This bone is relatively longer and thicker than the preceding. *Purchased*, 1869.

42283. The left humerus of a large individual; from the Kimeridge Clay of the Isle of Portland. This specimen has not suffered from crushing, and is characterized by its extreme breadth, and the short downward extent of the trochanteric ridge on the dorsal surface. *Purchased*, 1869.

R. 275. The left humerus of an enormous individual; from the Kimeridge Clay of Shotover. This specimen is remarkable for its extreme elongation, and forms a marked contrast to the preceding specimen, from which it appears specifically distinct. *Egerton Collection.*

R. 472 a. A bone regarded as a right femur of a comparatively large individual; from the Oxford Clay of Stanground, near Peterborough. There are two distal facets; and the general contour approximates to that of the smaller femur of *I. entheciodon* (fig. 16). This specimen in respect of mineral condition so closely resembles the femur No. R. 472 mentioned under the head of *Ophthalmosaurus icenicus* (p. 12), that it looks as though it belonged to the same individual. If this should be so, the present specimen would be the humerus, which would have two distal facets while the femur had three.

Presented by Sir R. Owen, K.C.B., 1884.

46803. A smaller imperfect left femur; from the Kimeridge Clay of Foxhangers, near Devizes, Wiltshire.

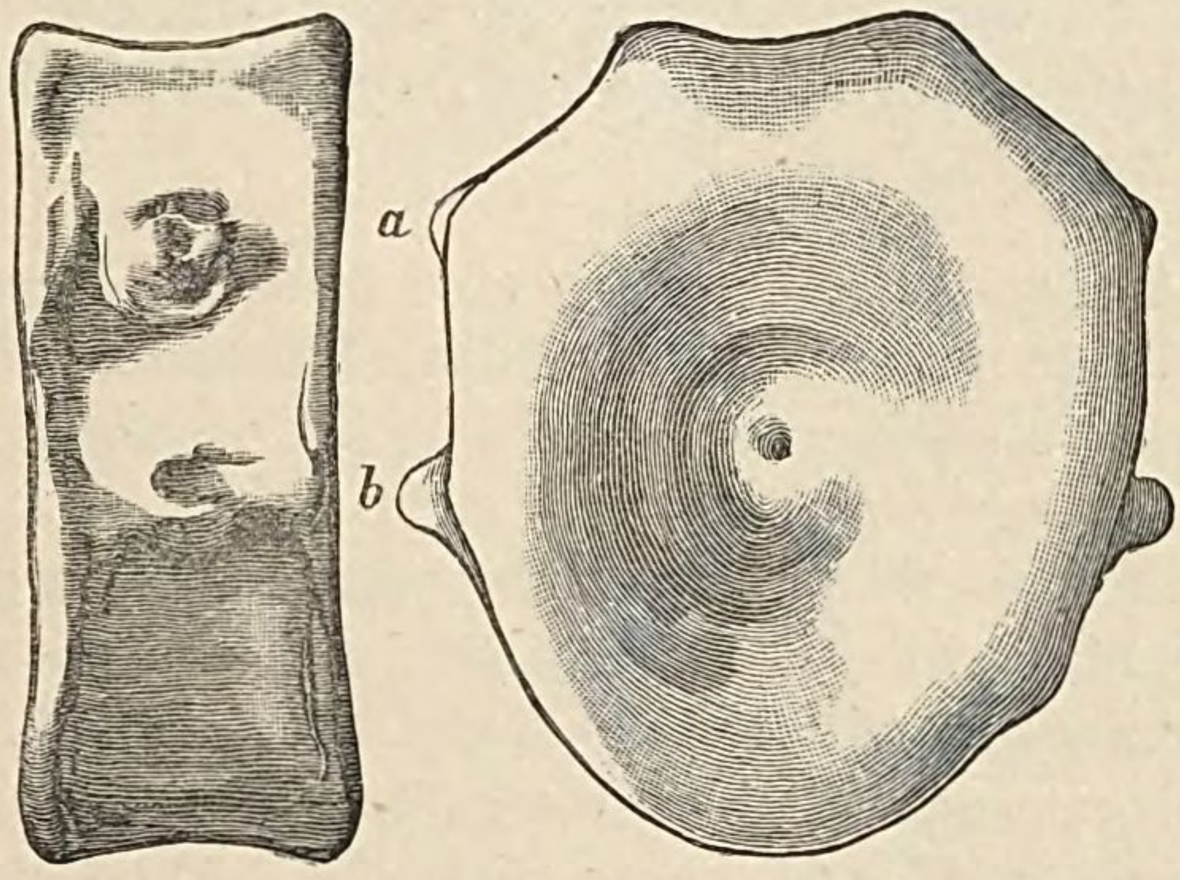
Cunnington Collection. Purchased, 1875.

Ichthyosaurus ovalis, Phillips [1].

Of large size. Known only by vertebral centra, which in the dorsal and anterior caudal regions have oval terminal faces, with the vertical diameter longer than the transverse. The type specimens have not been figured. The possibility of this contour of the vertebræ having been produced by crushing must be borne in mind.

Hab. Europe (England).

Fig. 15.



Ichthyosaurus ovalis.—Left lateral and anterior aspects of the centrum of a middle dorsal vertebra; from the Kimeridge Clay of the Isle of Portland. $\frac{1}{3}$. *a*, upper, *b*, lower costal tubercle.

[1] Geology of Oxford, p. 339 (1871).

42282. The centrum of a large middle dorsal vertebra; from the (*Fig.*) Kimeridge Clay (Upper Jurassic) of the Isle of Portland. The vertical diameter of this specimen (fig. 15) is 0,125, the transverse 0,110, and the length 0,048. In one of the type posterior dorsals described by Phillips the corresponding diameters are 0,078, 0,073, and 0,032.

Purchased, 1869.

44637. The centrum of a caudal vertebra probably referable to this species; from the Kimeridge Clay of Weymouth, Dorsetshire. The specimen is slightly distorted. Its vertical diameter is 0,061, and the transverse 0.051.

Purchased, 1873.

Ichthyosaurus (?) dilatatus, Phillips [1].

Centra of dorsal and caudal vertebræ described as of the general type of those of *I. trigonus*, but relatively wider and shorter, and rather less deeply cupped. In the undermentioned specimens the crowns of the teeth are very long and deeply fluted.

In the absence of figures of the types it is difficult to refer other specimens with certainty to this species, which appears to have attained large dimensions, and the following references are therefore provisional. The first of the undermentioned specimens agree so closely with *I. hildesiensis*, Koken [2], from the Lower Greensand of North Germany, that were it not for their much lower geological horizon they might be referred to the same species. If the absence of large teeth be an invariable characteristic of *Ophthalmosaurus* the following specimens are not referable to that genus.

Hab. Europe (England).

45984–7. A series of associated bones; from the Kimeridge Clay (Upper Jurassic) of Swindon, Wiltshire. These specimens comprise the basioccipital, basisphenoid, fragments of jaws with teeth, and eight centra of anterior and middle dorsal vertebræ. The vertebræ agree approximately in size with No. 24684 *b* of *I. trigonus*, but are shorter and wider, with the cupping of the faces rather less deep. In one example the vertical diameter is 0,076, the transverse 0,087, and the length 0,034. Although the distortion to which they have been subject renders exact comparison difficult, they appear to be wider than the dorsals

[1] Geology of Oxford, p. 307 (1871).

[2] Zeitschr. deutsch. geol. Ges. vol. xxxv. p. 761 (1883).

of the series referred to *Ophthalmosaurus icenicus* (p. 10). One of the teeth shows the thick investing coat of cement on the root; but the other, which is in germ, exhibits the inner fluted layer. The teeth agree precisely with the type tooth of *I. hildesiensis*, figured by Koken in the 'Zeitschr. deutsch. geol. Ges.' vol. xxxv. pl. xxiv. fig. 3; and the vertebral centra apparently closely resemble the lateral view of a dorsal centrum given in fig. 2 of the same plate. *Presented by H. F. Mills, Esq.*, 1874.

39158. The centra of an associated anterior cervical, middle (*a*) and early posterior (*b*) dorsal vertebra, apparently belonging to the same species as the preceding; from the Kimeridge Clay of Kimeridge, Dorsetshire. In the cervical the vertical diameter is 0,062 and the transverse 0,071; in the middle dorsal these dimensions are 0,079 and 0,087; and in the posterior dorsal 0,065 and 0,064. The middle dorsal appears indistinguishable from the vertebræ of the preceding series. The cervical is somewhat wider than that of *I. hildesiensis*, figured by Koken, *op. cit.* fig. 1.
Bowerbank Collection. Purchased, 1865.

Ichthyosaurus leptospondylus, Wagner [1].

Imperfectly known, but closely allied to if not identical with the following. Wagner first figured two teeth in the Abh. k. bay. Ak. Wiss. vol. vii. pt. 1, pl. vi. figs. 14–19 (1853), and subsequently several portions of an imperfect skeleton in vol. ix. pt. 1, pl. vi. (1861). The latter specimens comprise teeth, part of the sclerotic of the eye, scapulæ and coracoids, a vertebral centrum, and the disconnected bones of a paddle. This species was referred to the present group by Kiprijanoff in the 'Mém. Ac. Imp. St. Pétersbourg,' vol. xxviii. art. 8, p. 91.

Hab. Europe (Bavaria).

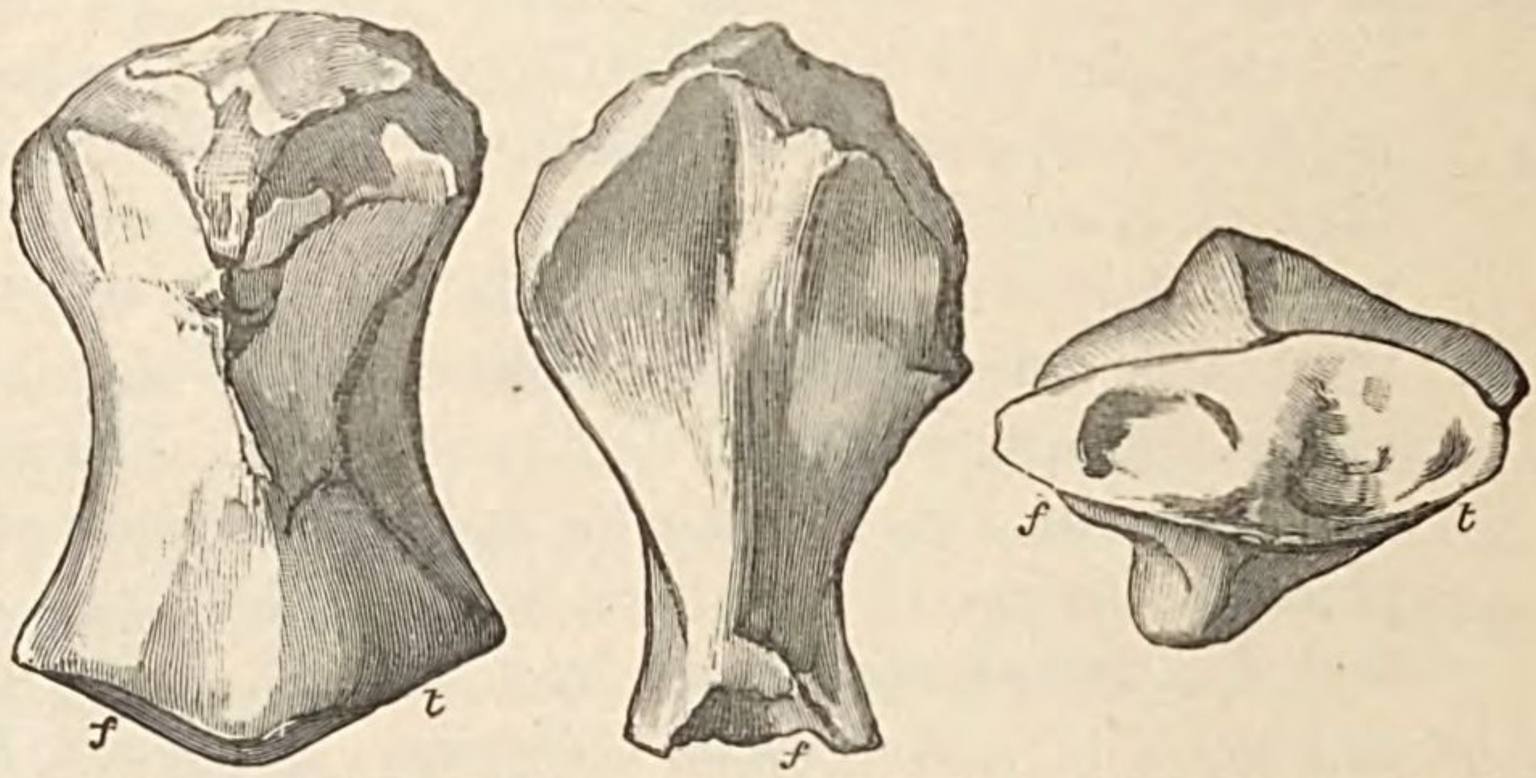
42833. (*Fig.*) Part of a slab of limestone, showing the frontal aspect of the rostral portion of the cranium; from the Kimeridgian Lithographic limestones of Eichstadt, Bavaria. Figured by Meyer in the 'Palæontographica,' vol. xi. pl. xxxiii., and provisionally referred to the present species. The resemblance of the teeth to those of the type specimens figured by Wagner, *op. cit.*, leaves little doubt as to their specific identity. The form of the rostrum and the structure of the teeth closely resemble the corresponding parts in *I. entheciodon*. *Van Breda Collection. Purchased*, 1871.

[1] Gelehrte Anzeigen, vol. xxxvi. p. 26 (1853).

Ichthyosaurus entheciodon, Hulke [1].

Typically of medium size. Cranial rostrum very long and slender ; teeth small, with bulbous roots. Vertebræ (if No. 46473 *e* be rightly referred) with the cupping of the posterior face of the centra confined to the central region, and the costal tubercles of the dorsals very small. Inner border of coracoids greatly elongated. Femur (fig. 16) long, with its trochanteric and opposite ridges moderately developed, so that the lateral surface of the proximal

Fig. 16.



Ichthyosaurus entheciodon.—Dorsal, postaxial, and distal aspects of the right femur ; from the Kimeridge Clay of Weymouth. ½ *a*, trochanteric ridge , *t*, tibial, *f*, fibular facet.

portion is narrower than the dorsal. Limbs relatively very small ; the humerus and femur in the type skeleton being not larger than in *I. latifrons* (*infra*, p. 89), where the vertebral centra are only half the size of those of the present form ; whether this form is really distinct from the preceding species remains to be proved.

Hab. Europe (England).

46497. (*Fig.*) Slab showing the right lateral aspect of the nearly entire skeleton ; from the Kimeridge Clay (Upper Jurassic) of Kimeridge Bay, Dorsetshire. Described and figured by Hulke in the ' Quart. Journ. Geol. Soc.' vol. xxvii. p. 440, pl. xvii. This specimen is in rather bad preservation ; the extremity of the caudal region is wanting, and of the limbs only the proximal portions remain. The pentagonal contour of the cervical centra can be distinctly seen where the vertebræ are partially displaced. The dorsal aspect of the humerus shows a strong trochanteric ridge ; while both this bone and the femur articulate distally with the

[1] Quart. Journ. Geol. Soc. vol. xxvii. pp. 30, 440 (1871)—amended. In vol. xxvi. p. 174 (1870) the name *Enthekiodon* was applied in a generic sense to teeth of this species.

normal two bones. In one limb the entire anterior border of the radius is shown, which also exhibits the transversely elongated form characteristic of the group.

Presented by J. C. Mansel-Pleydell, Esq., 1871.

46497 a. (*Fig.*) Proximal portion of the right pelvic limb; from the Kimeridge Clay of Kimeridge Bay. The femur, tibia, fibula, tibiale, and intermedium remain in their natural positions. The femur exhibits a prominent trochanteric ridge on the dorsal aspect; and the tibia is transversely elongated, and shows an entire anterior border. The specimen agrees precisely with the imperfect pelvic limb of the type skeleton. The femur (woodcut, fig. 16) exhibits the elongated form and moderate expansion of the postaxial surface characteristic of the corresponding bone of the type specimen.

Presented by J. C. Mansel-Pleydell, Esq., 1875.

R. 1197. Slab showing portion of a skeleton probably belonging to this species; apparently from the Kimeridge Clay, locality unknown. The remains comprise the imperfect centra of seven anterior caudal vertebræ, a number of terminal caudals, the imperfect pelvis, and a considerable portion of the left pectoral limb. The contour of the anterior caudals accords exactly with that of the type. The humerus shows a strongly marked trochanteric ridge and cannot be distinguished from the corresponding bone of the type. The radius is in apposition and shows the entire anterior border and transversely elongated contour; the intermedium is slightly displaced, the ulna wanting, and the remaining bones in confusion. *No history.*

46473 e. (*Fig.*) An associated series of thirty-five vertebral centra provisionally referred to this species; from the Kimeridge Clay of Foxhangers, near Devizes, Wiltshire. This series comprises cervicals, dorsals, and caudals; and the following specimens have been figured by Owen in his 'Liassic Reptilia' (Mon. Pal. Soc.), pt. iii. pl. xxii. (1881), viz.:— a cervical in figs. 1, 2; an anterior dorsal, which has been bisected in a vertical antero-posterior plane, in figs. 4–6 (also in woodcut, fig. 3, p. 4 of this volume); a posterior dorsal in figs. 7, 8; and a caudal in figs. 9–11. The terminal faces of the cervicals and middle dorsals are slightly elongated transversely, and those of the posterior

dorsals and anterior caudals narrowed superiorly. In the cervicals and dorsals the cupping of the posterior face is confined to the central region, as in the cervicals of *Ophthalmosaurus icenicus*. The dorsals agree precisely in size with those of the type skeleton, and have the costal tubercles of similarly small size. Owen figured the above mentioned dorsal under the name of *I. latimanus* (see *infrà*, pp. 53, 54).

Cunnington Collection. Purchased, 1875.

47424. A femur, probably belonging either to the present or a closely allied species; from the Oxford Clay of Peterborough, Northamptonshire.

Sharp Collection. Purchased, 1876.

Incertæ Sedis.

** **Ichthyosaurus (?) thyreospondylus,** Phillips[1] (*ex* Owen[2]).

Syn. (?) *Ichthyosaurus brachyspondylus*, Owen[3].

Of uncertain generic position, and only provisionally admitted as a species. Known only by detached vertebral centra remarkable for their very short antero-posterior diameter.

I. thyreospondylus of Owen was founded upon vertebræ preserved in the Bristol Museum, of which the horizon is not stated; that form has been quoted as of Liassic age, but Phillips suggests that the types are from the Kimeridge Clay of Weymouth. The vertebræ described by Owen under the name of *I. brachyspondylus* appear very similar to those figured by Phillips, but in this case also no geological horizon is given. Owen, indeed, states that similar vertebræ are found in the higher Jurassic of Russia, but those figured by Kiprijanoff in the 'Mém. Ac. Imp. St. Pétersbourg,' vol. xxxi. art. 6, pl. ix., under the name of *Polyptychodon*, but subsequently referred to *I. brachyspondylus*, are of Cretaceous age.

Hab. Europe (England).

46794 a. The centrum of a cervical vertebra; from the Kimeridge Clay, near Devizes, Wiltshire.

Cunnington Collection. Purchased, 1875.

46794 c. The centrum of a smaller cervical vertebra; from the same locality. *Cunnington Collection.*

[1] Geology of Oxford, pp. 307, 337 (1871).
[2] Rep. Brit. Assoc. for 1839, p. 124 (1840).
[3] Liassic Reptilia (Mon. Pal. Soc.), pt. iii. p. 127 (1881).

41776 c. The centrum of an early posterior dorsal vertebra; from the Kimeridge Clay of the Isle of Portland, Dorsetshire. The vertical diameter is 0,095 (3·75 inches), the transverse 0,111 (4·35 inches), and the length 0,031 (1·2 inch); the costal facets have united into a single one placed rather below the median horizontal line. In contour this specimen closely resembles the rather larger posterior dorsal figured by Phillips in his 'Geology of Oxford,' p. 338, diagram 130, figs. 3, 4, but in that specimen the costal facets are distinct. The contour of this specimen bears the same relation to the next as presented by the centrum of *I. trigonus*, No. R. 9 (p. 25) to No. 24684 *d* (p. 26). *Purchased*, 1869.

47428. The centrum of a late posterior dorsal vertebra; from the Oxford Clay of Whittlesea, near Peterborough. Vertical diameter 0,100 (3·9 inches), transverse diameter 0,106 (4·15 inches), length 0,025 (1·3 inch). The costal facets are double, and the contour of the terminal faces is similar to that of the corresponding vertebra of *I. trigonus*, No. 24684 *d* (p. 26).

Sharp Collection. Purchased, 1876.

47428 a. The centrum of an anterior caudal vertebra, associated with the preceding. Although somewhat larger (which may be due to pressure) this specimen closely accords with the caudal figured by Phillips in his 'Geology of Oxford,' p. 338. *Sharp Collection.*

41776 d. The centrum of a smaller caudal vertebra; from the Kimeridge Clay of Weymouth, Dorsetshire.

Purchased, 1869.

46794 b. The centrum of a caudal vertebra; from near Devizes. The centre is perforated. *Cunnington Collection.*

Specifically undetermined specimens from the Kimeridge and Oxford Clays belonging either to Ichthyosaurus or Ophthalmosaurus.

41881, 42371, 43290. Five imperfect teeth, of a more slender type than those referred to *I. trigonus* and *I. dilatatus*; from the Kimeridge Clay of Weymouth, Dorsetshire.

Purchased.

46790. A comparatively large left quadrate; from the Kimeridge Clay of Foxhangers, near Devizes, Wiltshire.
Cunnington Collection. Purchased, 1875.

46791. A rather smaller quadrate of the same side; from Foxhangers. *Cunnington Collection.*

43294. Three specimens of the articular bone of the mandible of a large individual; from the Kimeridge Clay of Weymouth, Dorsetshire. *Purchased*, 1871.

42373. Two very similar specimens; from Weymouth.
Purchased, 1871.

45905. The basioccipital of a large form; from the Kimeridge Clay of Weymouth. This specimen is somewhat waterworn.
Purchased, 1874.

45907. A slightly smaller basioccipital; from Weymouth.
Purchased, 1874.

41776. A very similar basioccipital, in a somewhat crushed condition; from Weymouth. *Purchased*, 1869.

41776 a. The basisphenoid of a very large individual; from Weymouth. This specimen is characterized by the shortness of the antero-posterior diameter of the palatal surface.
Purchased, 1869.

40337. The basisphenoid of an equally large but specifically distinct form; from Weymouth. The palatal surface is elongated antero-posteriorly. *Purchased*, 1867.

45906. A smaller basisphenoid of similar type; from Weymouth.
Purchased, 1874.

47326. The imperfect basisphenoid of a large form; from the Kimeridge Clay of Swindon, Wiltshire. *Presented by the Directors of the Swindon Brick and Tile Company*, 1876.

R. 472. A smaller basisphenoid; from the Oxford Clay of Stanground, near Peterborough, Northamptonshire.
Presented by Sir R. Owen, K.C.B., 1884.

R. 494. Cast of the extremity of the mandible of a comparatively small form. The original was obtained from the Upper Jurassic of Monte Lessini, in the Tyrolese Alps (Verona), Italy. The teeth appear to have been small, and the

specimen may indicate a form closely allied to or identical with *I. entheciodon* or *I. leptospondylus*.

Presented by Count Stephano de Stephani, 1882.

46804. The right articular bone of the mandible of a large individual; from Wiltshire. The corresponding bone is seen *in situ* in the undetermined skull, No. 49203, mentioned under the head of the Acutirostrine subgroup (p. 72).

Cunnington Collection. Purchased, 1875.

45908. A similar specimen from the left side; from Weymouth.

Purchased, 1874.

41979. A broken articular of the right side; from Weymouth.

Purchased, 1870.

32701. The anchylosed centra of the atlas, axis, and third cervical vertebræ of a large individual; from the Oxford Clay Vaches Noires (Calvados), France. The suture between the atlas and axis is completely obliterated, and the facet for the cranial intercentrum is united with that for the intercentrum between the atlas and axis.

Tesson Collection. Purchased, 1857.

R. 32. The centrum of an anterior cervical vertebra of a medium-sized form; from the Kimeridge Clay of Sweaton, Lincolnshire. The upper costal facet was placed entirely on the arch; as in the cervicals of the imperfect skeleton from the Oxford Clay mentioned by Seeley on p. 110 of his 'Index to Aves &c. in Cambridge Museum,' under the name of *I. megalodirus*. It has a strong general resemblance to the cervical of *I. hildesiensis* figured by Koken in the 'Zeitschr. deutsch. geol. Ges.' vol. xxxv. pl. xxiv. fig. 1.

Purchased, 1880.

40551. The centrum of a slightly larger and somewhat later cervical vertebra; from the Kimeridge Clay of Weymouth, Dorsetshire.

Sharp Collection. Purchased, 1876.

32704. The centrum of a cervical vertebra, very similar to No. R. 32 but rather later in the series; probably from the Kimeridge or Oxford Clay of Vaches Noires (Calvados), France. Perhaps associated with No. 32701.

Tesson Collection.

44637. An associated series of vertebral centra of a medium-sized individual; from the Kimeridge Clay of Weymouth. This series comprises 7 middle dorsals, 6 posterior dorsals, 4 anterior caudals, and 23 from the middle of the caudal region. The centra are of medium length; the transverse diameter of the middle dorsals exceeds the vertical; and the posterior dorsals and anterior caudals are narrowed superiorly. *Purchased*, 1873.

41236. An associated series of vertebral centra of a small individual; from the Kimeridge Clay of Weymouth. The cervicals and dorsals have the transverse diameter longer than the vertical; and the caudals are somewhat narrowed superiorly. *Purchased*, 1868.

46794 d. Nine associated vertebral centra of a rather larger form; from the Kimeridge Clay near Devizes. The middle dorsals have the faces nearly circular, deeply cupped, and the length considerable. *Cunnington Collection.*

46473 b. An associated series of nine caudal vertebræ of a small individual; from Foxhangers. One centrum belongs to the anterior part of the series. *Cunnington Collection.*

41776 e. Two associated centra of medium-sized middle dorsal vertebræ; from the Kimeridge Clay of Weymouth. The transverse diameter rather exceeds the vertical. *Purchased*, 1869.

41801. The imperfect centrum of a posterior dorsal vertebra of medium size; from the Kimeridge Clay of Ely, Cambridgeshire. *Purchased*, 1869.

24684 i. The centrum of a very similar posterior dorsal vertebra; from the Kimeridge Clay of Wootton-Bassett, Wiltshire. *Cunnington Collection.* *Purchased*, 1849.

48041. The centrum of a slightly larger posterior dorsal vertebra; from the Kimeridge Clay. *Presented by Sir R. Owen, K.C.B.*, 1860.

41776 f. The centrum of a very similar posterior dorsal vertebra; from Weymouth. *Purchased*, 1869.

46331. The ventral half of the centrum of an early posterior dorsal vertebra; from the Kimeridge Clay of Scend Hill,

Northamptonshire. The transverse diameter is 0,090, and the length 0,034; the contour being similar to that of the vertebra of *I. trigonus*, No. R. 9 (p. 25).
Cunnington Collection.

R. 8. The centrum of a large posterior dorsal vertebra; from the Kimeridge Clay of Stanton, near Bury St. Edmunds, Suffolk. *Purchased*, 1880.

32704 a. The centra of two caudal vertebræ, probably associated with the cervical, No. 32704. *Tesson Collection.*

41776 q. The centrum of a rather smaller caudal vertebra; from Weymouth. *Purchased*, 1869.

24684 j. The centrum of a still smaller caudal vertebra; from Wootton-Bassett.
Cunnington Collection. *Purchased*, 1849.

46473 g. The centrum of a caudal vertebra agreeing in size with the preceding, but less narrowed superiorly; from Foxhangers. *Cunnington Collection.* *Purchased*, 1875.

41776 h. Three smaller associated centra of caudal vertebræ; from Weymouth. The faces are deeply cupped.
Purchased, 1869.

41776 i. The centrum of a larger caudal vertebra; from Weymouth. The faces are nearly flat, with a deep pit in the middle, as in No. 24684 *j*. *Purchased*, 1869.

46473 h. A very similar centrum; from Foxhangers.
Cunnington Collection. *Purchased*, 1875.

46473 i. A rather smaller centrum of similar type; from Foxhangers. *Purchased*, 1875.

24804. Two centra of small caudal vertebræ; from the Kimeridge Clay of Potterne, Wiltshire.
Cunnington Collection. *Purchased*, 1849.

24684 k. The centrum of a small caudal vertebra; from Wootton-Bassett. The faces are deeply cupped. *Purchased*, 1849.

41255. A rib; from the Portland Oolite of the Isle of Portland. The double head is well shown. *Purchased*, 1869.

41957. The left scapula of a comparatively large individual; from the Kimeridge Clay of Weymouth. *Purchased*, 1870.

43298. An imperfect left scapula; from the Kimeridge Clay of Weymouth. *Purchased*, 1871.

43299. An imperfect right scapula; from the Kimeridge Clay of Weymouth. *Purchased*, 1871.

44181. A crushed scapula; from the Kimeridge Clay of Weymouth. *Purchased*, 1873.

43297. An entire right scapula; from the Kimeridge Clay of Weymouth. The strong ridge on the anterior border of the dorsal aspect of the proximal extremity is beautifully shown. *Purchased*, 1871.

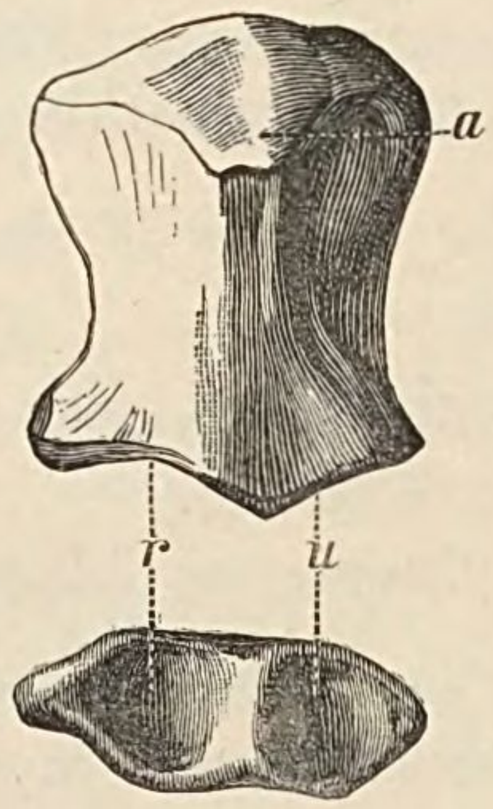
46472. The glenoidal extremities of the two scapulæ of a very large individual; from the Kimeridge Clay of Broughton-Gifford, Wiltshire. *Cunnington Collection*. *Purchased*, 1875.

32706. The glenoidal extremity of a right scapula, agreeing in size with the preceding; from the Oxford Clay of Vaches Noires (Calvados), France. The contour somewhat resembles that of the scapula of *I. zetlandicus*, No. 32671 (p. 81). *Tesson Collection.*

b. *Typical Subgroup.*

The roots of the teeth without an envelope of cement, and marked by larger and more numerous flutings than those of the crowns (fig. 19). Coracoid with posterior notch (fig. 4). Scapula with proximal extremity angulated, without anterior dorsal ridge, but with deep grooves on that surface above articular expansion.

Fig. 17.

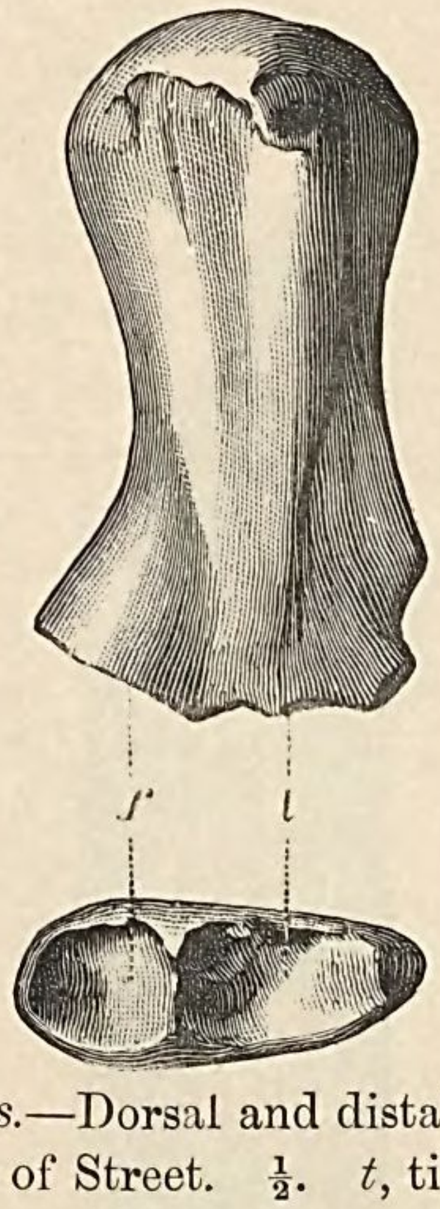


Ichthyosaurus (*cf.*) *communis*.—Dorsal and distal aspects of the left humerus; from the Lower Lias of Lyme-Regis. ½. *a*, trochanteric ridge; *r*, radial; *u*, ulnar facet.

Humerus (fig. 17) and femur (fig. 18) without strongly developed trochanteric ridge on dorsal surface. Cervical and anterior dorsal vertebræ with subcylindrical centra; and the superior costal articulation of the former in great part or wholly on the centrum.

This subgroup in the character of its humerus connects the preceding one with the Acutirostrine subgroup of the Longipinnate

Fig. 18.



Ichthyosaurus (*cf.*) *intermedius*.—Dorsal and distal a spects of the right femur; from the Lower Lias of Street. ½. *t*, tibial, *f*, fibular facet.

group. The cranial rostrum is never greatly elongated. The femur (fig. 18) is always unsymmetrical, long and narrow, with only a slight expansion of the distal extremity. In the humerus the proximal extremity has a more or less oblong contour, with the longer axis placed parallel to the longer axis of the distal surface. The pubis and ischium are long and narrow.

Ichthyosaurus communis, Conybeare [1].

Syn. *Ichthyosaurus chiropolyostinus*, Hawkins [2].

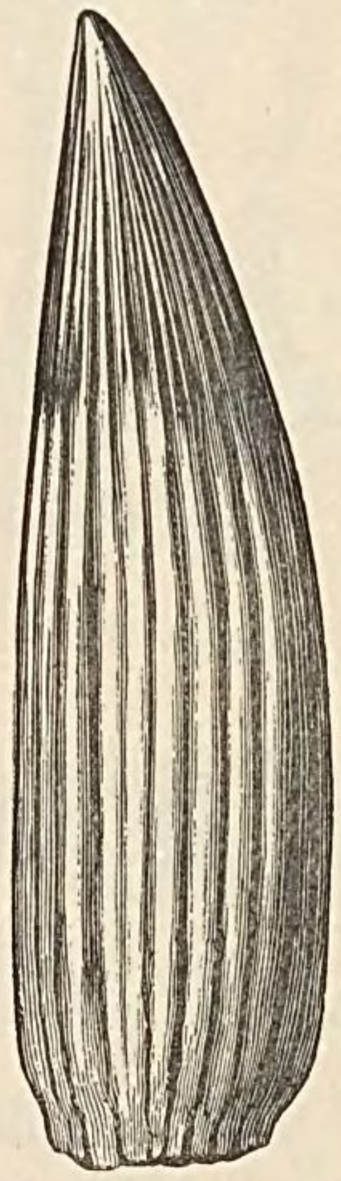
The type species. Teeth (fig. 19) relatively large, with short, thick crown, and the flutings on both crown and root strongly marked. Skull (fig. 21) with the length of the rostrum usually equal to rather less than three times the longer diameter of orbit. Supratemporal fossa small and triangular; and maxilla excluded from the narial aperture by union of premaxilla with lachrymal. Usually sixteen or seventeen plates in sclerotic. Vertebral centra

[1] Trans. Geol. Soc. ser. 2, vol. i. pt. i. p. 108 (1822).

[2] Memoirs on Ichthyosauri &c., pl. vii. (1834).

with moderately deep cups; neural spines of dorsal and cervical vertebræ very tall, their height exceeding twice the vertical diameter of the centra. Number of vertebræ generally about 140. Pectoral paddle (fig. 20) very broad, and usually about double the size of pelvic. There may be eight longitudinal rows of bones in middle of former, and six in latter. In pelvic paddle (fig. 20) anterior border of tibiale and succeeding tarsals of second row entire, and also the same border of anterior row of bones in pectoral paddle. Four

Fig. 19.



Ichthyosaurus communis.—Tooth; from the Lower Lias of Lyme-Regis. $\frac{1}{1}$.

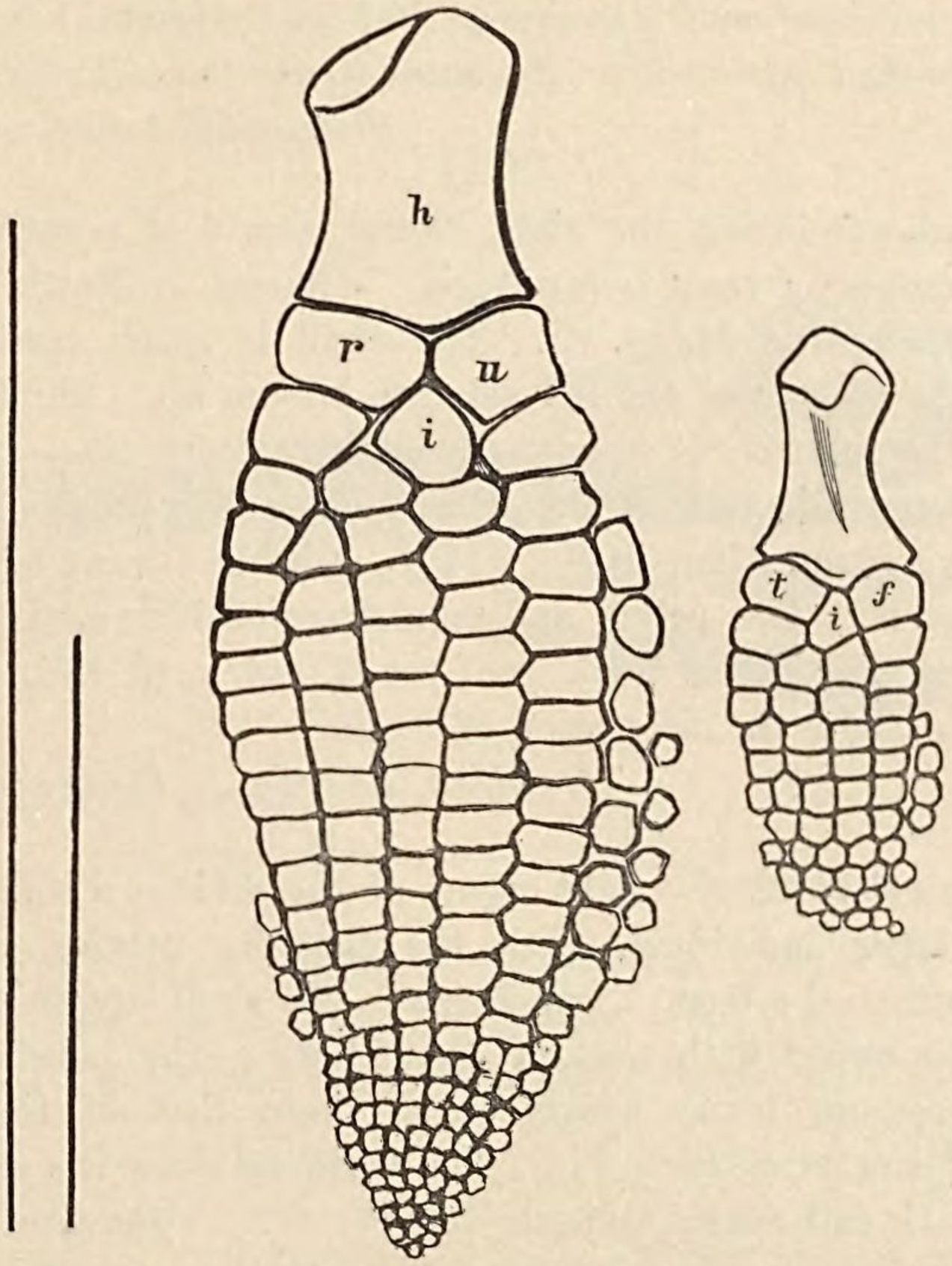
bones in third transverse row of pelvic paddle. Vascular foramina in centre of bones of paddles very minute and indistinct. Slight variations occur in the form of the paddles of different individuals included under the present specific heading; but these variations can scarcely be regarded as of more than racial importance. This species attained dimensions somewhat inferior to *I. lonchiodon*.

In the case of young skeletons and imperfect skulls, it is frequently difficult to distinguish between this species and *I. intermedius*.

Hab. Europe (England).

41849. (*Fig.*) Slab showing the left aspect of a medium-sized skeleton, wanting the greater part of the caudal region; from the Lower Lias of Lyme-Regis, Dorsetshire. The bones of the brain-case are much crushed, but the rostrum is well preserved, and considerably exceeds twice the longer diameter of the orbit. The dorsal aspect of the coracoids

Fig. 20.



Ichthyosaurus communis.—Dorsal aspect of the left pectoral and ventral aspect of the right pelvic limb of No. 41849. $\frac{1}{3}$. *h*, humerus; *r*, radius; *u*, ulna; *i*, intermedium; *t*, tibia; *f*, fibula. The vertical lines show the proportionate length of the pectoral limb to the skull; the longer line being the length of the skull.

and pectoral limbs are exposed; the left pectoral limb being thrown to the front. The paddles are nearly perfect and are broad and ovate in contour; the pectoral one containing 8 and the pelvic 6 longitudinal rows of phalangeals. The length of the pectoral limb (fig. 20) is 0,255 (10 inches), and its greatest width 0,090 (3·5 inches); the length of the skull being 0,432 (17 inches). The vertical lines in fig. 20 show the proportionate length of the paddle to the skull. In the pelvic limb the intermedium articulates with the femur (fig. 20).

Purchased, 1870.

1064. Cast of a slab showing an imperfect skeleton of medium size; the original was obtained from Lyme-Regis, and is pre-

served in the Bristol Museum. The skull and left pectoral limb are well preserved; but the vertebral column is broken up. *Presented by the Council of the Bristol Philosophical Institute*, 1832.

2001 *. (*Fig.*) Slab exhibiting the right lateral aspect of a rather small skeleton; from Lyme-Regis. Figured by Hawkins in his 'Sea Dragons,' pl. vii. The skull is much crushed, and the paddles of the left side are broken up. The length of the rostrum is apparently slightly more than twice the longer diameter of the orbit. The pelvic paddle, although narrower than in No. 41849, still has 6 rows of phalangeals. The pelvic and caudal region is figured by Owen in the 'Trans. Geol. Soc.' ser. 2, vol. v. pl. xlii., in order to show the dislocation of the tail.

Hawkins Collection. Purchased, 1834.

43971. Slab showing the right aspect of the skull of a considerably larger individual, with the first six cervical vertebræ attached; from Lyme-Regis. The skull agrees closely in character with that of No. 41849; the length of the rostrum being nearly three times that of the longer diameter of the orbit. The vertebræ show the characteristic tall neural spines. *Purchased*, 1872.

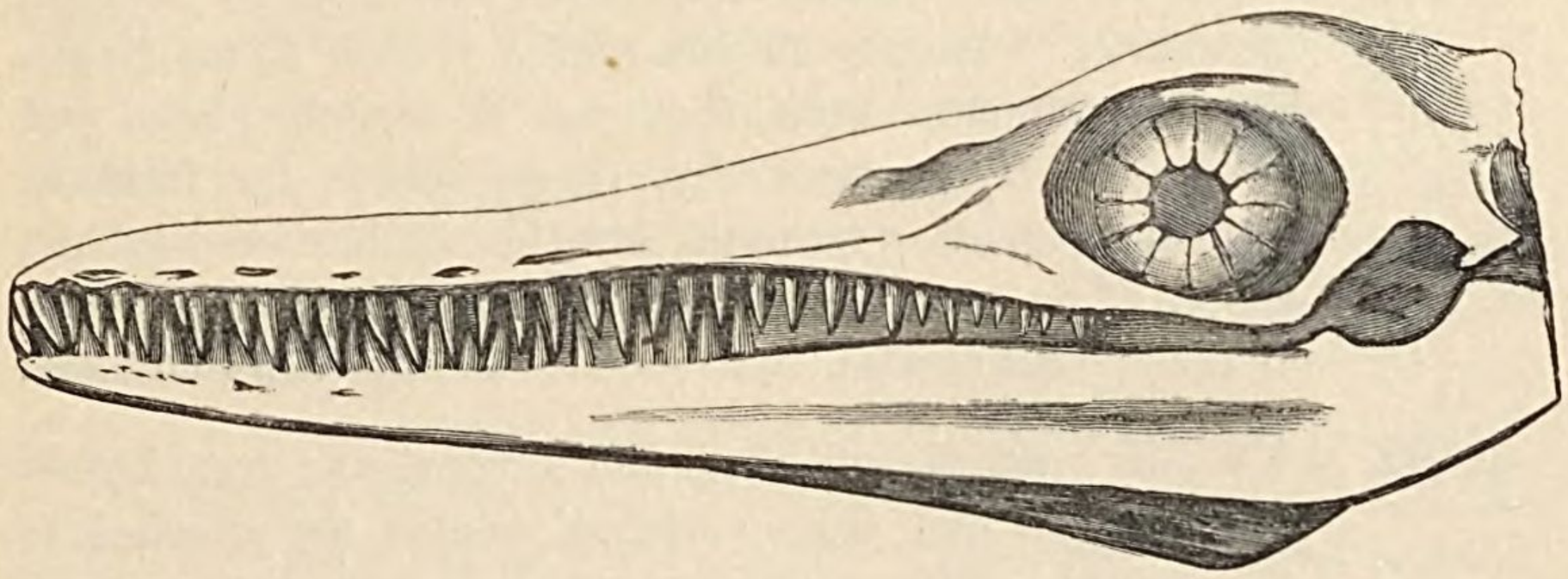
R. 1162. Slab showing the left lateral aspect of a small skeleton; from Lyme-Regis. On the left side the pelvic paddle is broken up, and on the right both paddles are destroyed, but the remainder of the skeleton is well preserved. The length of the rostrum somewhat exceeds twice that of the orbit. *No history.*

R. 311. (*Fig.*) A nearly entire skull agreeing very closely with No. 43961, but of considerably larger size; from Lyme-Regis. The entire length of this specimen (which is represented in fig. 21) is 0,834 (32·5 inches); and the length of the rostrum slightly exceeds three times the longer diameter of the orbit. The orbital region is imperfect and crushed, but the rostrum, the whole of the mandible, and the teeth are in excellent preservation. This specimen was collected by Miss Anning, and is the one noticed by Owen in the 'Rep. Brit. Assoc.' for 1839, p. 108, as being in the collection of Viscount Cole (subsequently Earl of Ennis-

killen), where it is referred to the present species. In the accompanying figure the orbit is restored [1].

Enniskillen Collection. *Purchased*, 1882.

Fig. 21.



Ichthyosaurus communis.—Left lateral aspect of the skull; from the Lower Lias of Lyme-Regis. About $\frac{1}{3}$.

25273. (*Fig.*) The rostrum of a skull agreeing closely in size with No. R. 311; from Lyme-Regis. The teeth are in beautiful preservation, one of them being represented in fig. 19.

Purchased, 1850.

R. 1163. The anterior extremity of a similar rostrum; from Lyme-Regis. Thirteen teeth remain in the mandible, in which the splenial extends to the extremity of the symphysis.

No history.

41379. The anterior portion of a mandible agreeing very closely with that of No. R. 311; from Lyme-Regis.

Purchased, 1869.

14593. Cast of an entire skull apparently belonging to this species. The original was obtained from the Lower Lias of Barrow-on-Soar, Leicestershire, and is preserved in the Museum of the Philosophical Institution at Birmingham. It is noticed by Owen in the 'Rep. Brit. Assoc.' for 1839, p. 110, where it is referred to the present species. This specimen has suffered but little from crushing; and exhibits very clearly the supratemporal fossæ. The length of the rostrum considerably exceeds three times the longer diameter of the

[1] The skull, No. 14, mentioned on page 138 of Seeley's 'Index to Aves &c. in Cambridge Museum' (1869), is very similar to the present specimen.

orbit; in which respect, as in its relatively large teeth, the specimen differs from *I. intermedius*.

Presented by the Council of the Birmingham Philosophical Institution.

R. 317. A distorted skull of somewhat smaller size than No. R. 311, apparently belonging to this species; from Lyme-Regis. The rostrum has been fractured in several places and has been curved upwards by pressure above the frontals. The right orbit is preserved, but the left has been broken away. The teeth exhibit all the characteristics of those of the present species. *Enniskillen Collection.*

39492. A laterally crushed skull of smaller dimensions; from Lyme-Regis. The first three vertebral centra are attached to the occiput. This specimen agrees exactly in size with the skull of *I. intermedius*, No. 2103 *, and exhibits the specific character of the much larger teeth very clearly.

Purchased, 1863.

R. 1164. A still smaller skull; from Lyme-Regis. The anterior vertebræ are attached, and the teeth are well preserved. The length of the rostrum slightly exceeds three times the longer diameter of the orbit. The right nares and orbit (with its sclerotic plates) are entire, but the left orbit is broken away. *Purchased.*

2002 *. (*Fig.*) Slab showing the left lateral aspect of the imperfect skull, anterior portion of the vertebral column, and part of the left pectoral girdle of a medium-sized individual apparently belonging to this species; probably from Lyme-Regis. Figured by Hawkins in his 'Sea Dragons,' pl. ix.

Hawkins Collection.

41159. Slab exhibiting the left lateral aspect of a crushed skull of medium size, probably belonging to the present species; from Lyme-Regis. The teeth are of the relatively large size characteristic of *I. communis*. At the occipital region of the skull numerous vertebral centra and bones of the paddles are preserved in the slab. *Purchased*, 1868.

33282. A large tooth, wanting the extremity of the crown; from Lyme-Regis. *Purchased*, 1858.

20568. Fragment of rock containing a tooth of similar type; from the Lower Lias, near Bath. *Purchased*, 1847.

11280. Fragment of Lias containing a smaller tooth probably belonging to this species; from Lyme-Regis.
Mantell Collection. Purchased, 1838.

R. 264. Three teeth probably belonging to large individuals of the present species; from Lyme-Regis. These teeth appear to be very similar to those in the large skull described by Owen. *Egerton Collection. Purchased*, 1882.

28319. Slab exhibiting the right lateral aspect of the nearly entire skeleton of a medium-sized individual; from Lyme-Regis. The pelvic limbs and the greater part of the caudal region are wanting. The skull and greater portion of the vertebral column are fairly well preserved; but the distal extremities of the pectoral paddles are absent. The tall neural spines of the dorsal vertebræ, and the broad pectoral paddles show the characteristic features of the species.
Purchased, 1853.

28305. Slab showing the ventral aspect of a medium-sized imperfect skull, together with fragments of the pectoral girdle and limbs, and some of the abdominal ribs, probably belonging to this species; from Lyme-Regis. The teeth and fragments of the paddles agree with typical examples.
Purchased, 1853.

R. 1071. Slab showing the left lateral aspect of the imperfect anterior portion of the skeleton of a somewhat smaller specimen apparently belonging to this species; from Lyme-Regis. The skull, left coracoid and pectoral limb, together with the anterior portion of the vertebral column, are preserved. *No history.*

The following young skeletons exhibit all the characteristic features of the present species, but it is possible that some may be specifically distinct.

R. 1072. Slab exhibiting the ventral aspect of the crushed skull, and the left lateral aspect of the greater portion of the rest of the skeleton of a small individual; from Lyme-Regis. The columella is noticed by A. Smith Woodward in the 'Proc. Zool. Soc.' 1886, p. 408. Both the pectoral and pelvic limbs of the left side are shown. The pelvic paddle is of the usual characteristic width, but is relatively larger in proportion to the pectoral than is usually the case. *No history.*

R. 1073. Slab exhibiting the left lateral aspect of a small skeleton;

from Lyme-Regis. The skull, vertebral column, and left limbs are well preserved. There are eight longitudinal rows of phalangeals in the pectoral, and six in the pelvic paddle. *No history.*

R. 1074. Slab showing the left lateral aspect of the nearly entire skeleton of a very small individual; from Lyme-Regis. The skull is much crushed, and the bones of the paddles are displaced. The dorsal vertebræ have the very tall neural spines characteristic of this species. *No history.*

38803. (*Fig.*) Slab showing the ventral aspect of the skeleton of a small individual; from Charmouth, Dorsetshire. Figured by Owen in his 'Liassic Reptilia' (Mon. Pal. Soc.), pt. iii. pl. xxx. figs. 3–5, as *I. communis*. The splenial is represented in the figure as entering but a short distance into the mandibular symphysis; but this seems to be an individual rather than a specific character. There are five longitudinal rows in the pelvic paddle, and the intermedium is pushed more between the tibiale and fibulare than is generally the case. *Purchased*, 1865.

39844. Slab showing the left lateral aspect of the skeleton of a very small individual; from Lyme-Regis. The skull is much crushed, but the left pectoral limb is well preserved.
Purchased, 1866.

36256. Slab exhibiting the left side of the skeleton of a small individual; from Lyme-Regis. The rostrum is of moderate length, and the paddles are of moderate width.
Purchased, 1862.

120. Slab showing the right lateral aspect of a small skeleton; from Lyme-Regis. The skull, vertebral column, and right pectoral paddles are well preserved, and there is coprolitic matter within the ribs. The rostrum is well developed; and the pectoral paddle is of moderate width and has six rows of phalangeals. *Purchased. About* 1835.

111. Slab exhibiting the left lateral aspect of a very small skeleton apparently belonging to this species; from Lyme-Regis. The vertebral column and limbs are much obscured by a pyritous deposit. *Presented by W. Broderip, Esq.*

33280. Slab showing the right lateral aspect of the imperfect skull and anterior part of the vertebral column of a small individual probably belonging to this species; from Lyme-

Regis. The height of the neural spines of the vertebræ affords the ground of specific reference. *Purchased*, 1858.

49204. Slab showing the ventral aspect of a small skeleton; from Lyme-Regis. The whole of the bones are well shown from this aspect. The pectoral paddles have seven, and the pelvic five rows of phalangeals. *Purchased*, 1878.

R. 1212. Slab showing the ventral aspect of a larger but imperfect skeleton agreeing very closely in characters with the preceding; from Lyme-Regis. The skull and paddles are fairly well preserved, but the vertebral column is broken up, and the caudal region wanting. *No history.*

R. 12. Slab exhibiting the right lateral aspect of the nearly entire skeleton of a very young individual not improbably belonging to the present species; from Lyme-Regis. The skull and both paddles of the right side are well preserved. *Purchased*, 1879.

33278. Slab showing the right lateral aspect of the imperfect skeleton of a small individual probably referable to this species; from Lyme-Regis. The skull is wanting, but the dorsal and anterior part of the caudal region of the vertebral column, as well as the ribs and abdominal ribs, are beautifully preserved. The limbs of the right side, in a dislocated condition, are also shown, as well as the scapula, imperfect coracoid, and clavicle of the same side. The pectoral limb had eight longitudinal rows, and shows all the characters of the present species. Within the ribs are masses of coprolitic matter marking the position of the stomach and the tract of the intestine. *Purchased*, 1858.

35567. Slab exhibiting part of the middle region of the skeleton of a small individual of this or a closely allied species; from Lyme-Regis. The centra of eight posterior dorsal vertebræ are shown, together with a number of ribs and the entire left pelvic limb, of which the dorsal aspect is exposed. Six longitudinal rows of bones are seen in the paddle. The right femur is seen beneath the ribs.

Purchased, 1858.

Some of the following specimens may be specifically distinct.

R. 1068. Slab exhibiting the ventral aspect of the pectoral girdle and limbs of a rather large individual; from Lyme-Regis.

The coracoids, clavicles, left scapula, and the nearly entire paddles of both sides are shown. The first row of phalangeals are of the elongated form and have the entire anterior border characteristic of the present species.

No history.

R. 1069. Cast of an imperfect pectoral girdle and the proximal portion of the right limb, together with several vertebral centra, not improbably belonging to this species. The original was probably obtained from Lyme-Regis and is preserved in the Paris Museum. The coracoids are preserved, but their posterior expansion is broken away, which causes them to appear relatively longer and narrower than they really are. The right scapula and clavicle together with the interclavicle are also preserved. In the limb the humerus, radius, ulna, and intermedium are preserved; the radius having the entire anterior border characteristic of the present group.

Mantell Collection. Purchased, 1838.

R. 224. Slab exhibiting the ventral aspect[1] of a nearly entire left pectoral limb probably belonging to a large individual of this species; from Lyme-Regis. The extreme length is 0,508. There are seven longitudinal rows in the widest part, and four bones in the third transverse row.

Purchased, 1882.

R. 1063. Slab exhibiting the dorsal aspect of the greater portion of a left pectoral paddle agreeing closely in size with the preceding specimen; from Lyme-Regis. The humerus and the distal phalangeals are wanting. There are but three oblong bones in the third row. *No history.*

R. 1064. Slab showing the dorsal aspect of both pectoral limbs of an individual agreeing nearly in size with No. 41849 (p. 42); from Lyme-Regis. The distal bones are wanting, and there are four oblong bones in the third row. *No history.*

R. 587. Slab exhibiting the entire right pectoral limb of an individual agreeing in size with the preceding; from Lyme-Regis. Eight rows can be counted in the middle. The humerus is imperfect. *Purchased*, 1885.

[1] It is not always easy to determine which surface of a paddle is exposed; if in any of the following specimens the surface should be wrongly determined such specimen will belong to the side opposite to that stated.

2161 *. Slab showing the dorsal aspect of a slightly imperfect bu very similar right pectoral paddle; probably from Lyme-Regis. *Bequeathed by Lieut.-Gen. Hardwicke.*

41356. Slab showing the dorsal aspect of a right pectoral paddle agreeing closely in size with the preceding; from Lyme-Regis. Ribs are also shown on the slab.

Purchased, 1869.

R. 318. Slab showing the ventral aspect of a very similar right pectoral paddle; from Lyme-Regis. The distal bones are restored in plaster.

Enniskillen Collection. Purchased, 1882.

R. 1065. Block of limestone containing the greater portion of a pectoral paddle apparently belonging to this species; probably from Lyme-Regis. *No history.*

R. 278. Slab exhibiting the two pectoral paddles, partly restored, of a medium-sized individual; from Lyme-Regis.

Egerton Collection. Purchased, 1882.

35565. A small right pectoral paddle with the dorsal aspect exposed, apparently belonging to this species; from Lyme-Regis.

Purchased, 1860.

R. 1276. Slab showing the ventral aspect of the left pectoral paddle, and the distal extremity of the opposite paddle of a medium-sized individual; from Lyme-Regis.

Harford Collection. Purchased, 1888.

29672. (*Fig.*) Slab showing the impressions of the bones and of the integument, together with some of the bones themselves, of an imperfect pelvic paddle probably belonging to the present species; from Barrow-on-Soar. The distal portion is entire. Figured by Owen in the 'Trans. Geol. Soc.' ser. 2, vol. vi. pt. i. pl. xx., and in his 'Liassic Reptilia' (Mon. Pal. Soc.), pt. iii. pl. xxviii. fig. 3, where it is provisionally referred to this species. A figure is also given by Mantell in his 'Petrifactions and their Teachings,' p. 374, fig. 76, and another by Kiprijanoff in the 'Mém. Ac. Imp. St. Pétersbourg,' vol. xxviii. art. 8, pl. ix. fig. 12 (1881).

Presented by Sir Philip de Malpas Grey Egerton, Bart., 1855.

** **Ichthyosaurus breviceps,** Owen [1].

Apparently closely allied to *I. communis*, but with the cranial rostrum unusually short, and not exceeding in length twice the longer diameter of the orbit. In the type specimen there are but three bones in the third transverse row of the pelvic paddle, which if constant may serve to confirm the right of this form to specific distinction from *I. communis*. The large cranium referred by Owen to the present species is entered under the head of *I. platyodon*.

Hab. Europe (England).

43006. (*Fig.*) Slab showing the left lateral aspect of a small skeleton; from the Lower Lias of Lyme-Regis, Dorsetshire. The type specimen. Figured by Owen in his 'Liassic Reptilia,' pt. iii. pl. xxix. fig. 2. The skull and limbs are well preserved. The length of the cranial rostrum is nearly twice the longer diameter of the orbit. The pectoral paddle has seven longitudinal rows of phalangeals and closely resembles that of *I. communis*, No. 2001* (p. 44), but only four rows are shown in the pelvic limb. It is difficult to see how this specimen can be specifically distinguished from the above mentioned skeleton of *I. communis*, unless the difference in the number of bones in the pelvic paddle be a constant character. *Purchased.*

R. 216. Slab showing the left lateral aspect of a skeleton of smaller size than the preceding; from Lyme-Regis. The paddles of the left side are shown, but the pelvic one is too imperfect for the determination of the arrangement of the bones. The pectoral limb has six longitudinal rows; and the tall neural spines of the vertebræ are well shown. The rostrum has a length equal to double the diameter of the orbit.

Presented by F. Seymour Haden, Esq., 1882.

39263. Slab exhibiting the right lateral aspect of a crushed cranium agreeing in characters with those of the preceding specimens; from Lyme-Regis. The length of the rostrum is somewhat less than twice the diameter of the orbit.

No history.

R. 1062. Slab exhibiting the right lateral aspect of a crushed cranium, the anterior part of the vertebral column, and right pectoral girdle and limb in a broken condition; not improbably belonging to this form; from Lyme-Regis.

No history.

[1] Liassic Reptilia (Mon. Pal. Soc.), pt. iii. p. 109 (1881).

Ichthyosaurus conybeari, Lydekker [1].

The two following specimens present characters connecting them both with *I. communis* and *I. intermedius*, and apparently indicate another species, presenting the following characters; the second specimen being the type. Teeth small, and skull relatively long in proportion to the vertebral column and limbs. Pectoral limb of moderate width, with anterior border of some of the first row of phalangeals notched. Pelvic limb with six longitudinal rows of phalangeals, and anterior border of the tibiale and adjacent tarsale of the second row notched.

It is not improbable that the skeleton in the Woodwardian Museum, Cambridge, from the Lower Lias of Barrow-on-Soar, recorded as No. 11 on page 138 of Seeley's 'Index to Aves &c. in Cambridge Museum' (1869), belongs to the present form. That specimen has six longitudinal rows of phalangeals in the pelvic limb, as in No. 1065. The name *I. latimanus*, Owen [2], cannot be applied to this form, for the reasons given under No. 1065; the vertebræ figured under that name by Owen in his 'Liassic Reptilia' (Mon. Pal. Soc.), pt. iii. pl. xxxiii., are from the Kimeridgian, and are noticed under the head of *I. entheciodon* (*suprà*, pp. 33, 34).

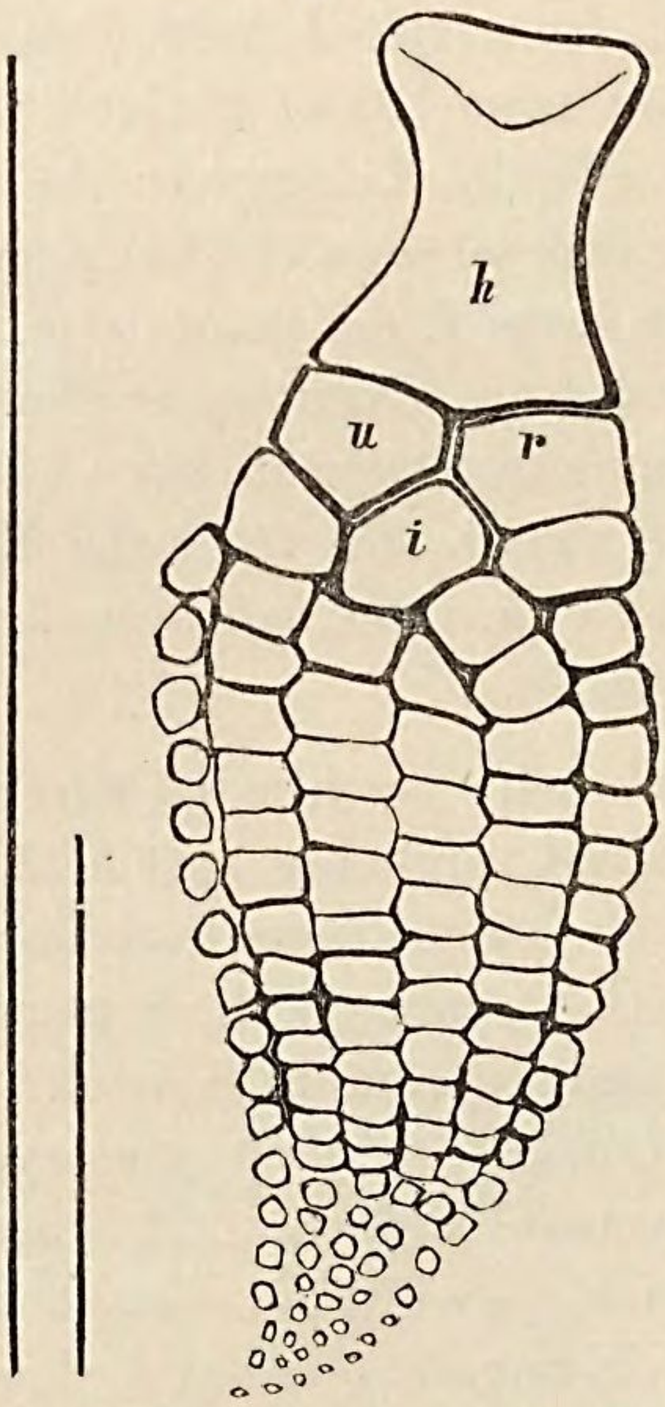
Hab. Europe (England).

1065. Cast of a slab showing the nearly entire skeleton of a medium-sized individual, probably specifically identical with the next specimen. The original was obtained from the Lower Lias of Saltford, near Bath, Somersetshire; and is preserved in the Museum at Bristol. The skull, although somewhat crushed, is well preserved, and is exhibited from the ventral aspect. The nearly entire vertebral column is also shown in an almost undisturbed condition. Both coracoids remain, one having been thrown down near the extremity of the rostrum; but the only traces of the pectoral limb are a few phalangeals near the displaced coracoid. Both pelvic limbs are preserved, and are still in connection with the pelvis, but have been thrust towards the thoracic region. There are six longitudinal rows of phalangeals in the pelvic limb, and the notching of the tibiale and adjacent tarsale is distinctly visible in the cast. It is stated that in the original specimen impressions of the soft parts can be seen in the matrix of the caudal region. It appears that Owen's *Ichthyosaurus*

[1] Geol. Mag. dec. 3, vol. v. p. 311 (1888).
[2] Rep. Brit. Assoc. for 1839, p. 123 (1840).

latimanus is based on a description of the present specimen mixed up with that of the specimen of *I. communis*, No. 1064 (p. 43). The present specimen having no pectoral limb cannot have afforded the diagnosis based on that part of the skeleton, while most of the dimensions given by Owen, as well as the number of the teeth, do not agree with those of this specimen. The description of impressions of the skin seems, however, to refer to this specimen; and the total length and general preservation of the vertebral column also tally with Owen's

Fig. 22.



Ichthyosaurus conybeari.—The ventral aspect of the left pectoral limb of No. 38523. $\frac{1}{2}$. *h*, humerus; *r*, radius; *u*, ulna; *i*, intermedium. The vertical lines show the relative lengths of the limb and the skull; the longer one being that of the skull drawn of the same absolute size as in fig. 20. The notches in the anterior border of the first row of phalangeals are omitted.

description. On the other hand, the condition of the vertebral column, and the dimensions of the pectoral limb of the above-mentioned skeleton of *I. communis* indicate the impossibility of that specimen alone having been the type of *I. latimanus*. On these grounds the latter name must be abolished. *Presented by the Council of the Bristol Philosophical Institute*, 1839.

38523. (*Fig.*) Slab showing the right lateral aspect of the anterior portion of a smaller skeleton; from the Lower Lias of Lyme-Regis, Dorsetshire. The type specimen. The crushed skull, the thoracic region (enclosing coprolitic matter), and the ventral aspect of the left pectoral limb (fig. 22) are shown. The right humerus and some scattered distal bones of the paddle also remain; and both coracoids are shown. The anterior border of some of the first row of phalangeals is notched, although not shown in the figure. The skull bears a greater proportionate length to the vertebral column than in the skeleton No. 41849 of *I. communis* (p. 42); and in this respect this specimen agrees with the preceding. The length of the skull is 0,292 (11·5 inches), and that of the pectoral limb 0,115 (4·5 inches). The length of the pectoral limb relatively to that of the skull is therefore much greater than in *I. communis*, No. 41849; the relative proportion of the limb to the skull being about $\frac{2}{5}$. The phalangeals are also relatively larger. The presence of six longitudinal rows of phalangeals, and the entire anterior border of the radius and the radiale forbid the reference of this specimen to any member of the Longipinnate group; and if it be not specifically identical with the preceding specimen the latter would seem to indicate another unnamed species.

Purchased, 1836.

Ichthyosaurus intermedius, Conybeare[1].

Syn. *Ichthyosaurus chiroparamecostinus*, Hawkins[2].

Distinguished from the type species by the following characters. Teeth relatively smaller and longer, with the flutings on the crown finer, and those on the root less strongly marked. Neural spines of cervical and dorsal vertebræ somewhat lower. Paddles (fig. 23), generally narrower, with five or six longitudinal rows of bones in middle of pectoral, and four or five in pelvic. In pelvic paddle anterior border of tibiale and adjacent tarsale of second row notched; and when there are five longitudinal rows of oblong bones in middle of pectoral paddle those of first row nearly square (instead of oblong), with their anterior border notched. Vascular foramina in centre of bones of paddles large and distinct[3]. Clavicles more

[1] Trans. Geol. Soc. ser. 2, vol. i. pt. 1, p. 108 (1822).

[2] Memoirs on Ichthyosauri &c. pl. xviii. (1834).

[3] This character was pointed out by Hawkins, and although its validity was discredited by Owen, it appears to be distinctive.

slender, and glenoid cavity of pectoral girdle relatively smaller. The length of the cranial rostrum appears to be always less than three times the longer diameter of the orbit.

This species does not appear to have attained such large dimensions as *I. communis*; the length of the largest known individuals being about seven feet. While *I. communis* seems to be the common form at Lyme-Regis, the present species seems to be the more abundant at Street.

The above-mentioned characters are exhibited not only by the under-mentioned specimens, but also by the skeletons marked 1, 2, and 12, on page 138 of Seeley's 'Index to Aves &c. in Cambridge Museum' (1869), which the writer has satisfied himself by personal observation belong to this species. The narrower paddles and the notching of the anterior border of some of the bones of their first row indicates that this species connects *I. communis* with the Longipinnate group. This species is recorded both from the Upper and Lower Lias.

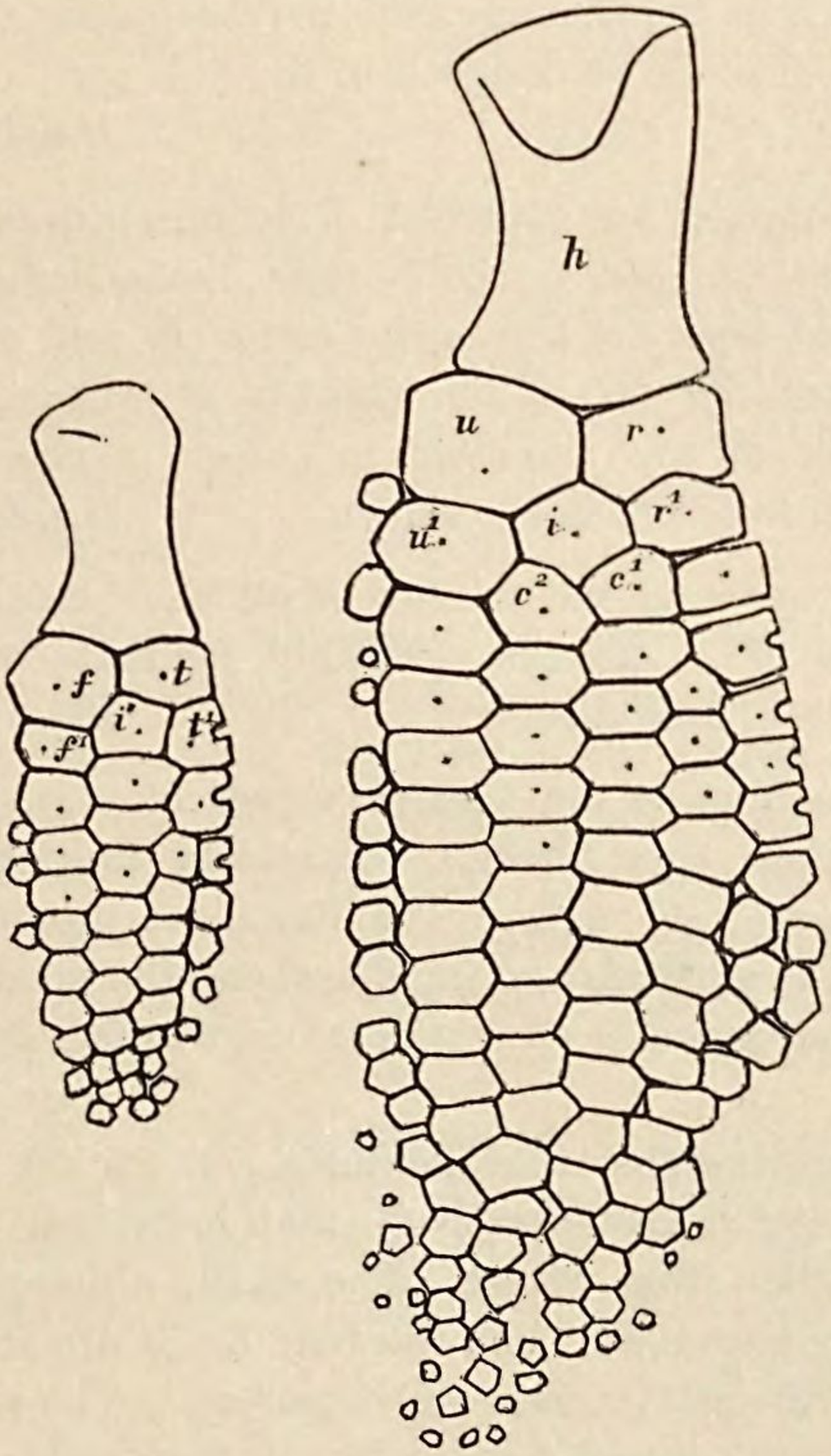
Hab. Europe (England and (?) Würtemberg).

2013 *. (*Fig.*) Slab showing an oblique view of the dorsal and right lateral aspects of a large skeleton; from the Lower Lias of Street, near Glastonbury, Somersetshire. Figured by Hawkins in his 'Sea Dragons,' pl. xvii.; and also by Owen in his 'Liassic Reptilia' (Mon. Pal. Soc.), pt. iii. pl. xxx. figs. 1, 2. The skull and limbs are well preserved. The pectoral has six, and the pelvic limb four longitudinal rows of phalangeals. The notches in the tibiale and adjacent tarsale of second row are well shown; as also are those in the anterior phalangeals of the pectoral limb. There are three bones in the second row of the tarsus. The pelvic and caudal region is figured by Owen in the 'Trans. Geol. Soc.' ser. 2, vol. v. pl. xlii. The right limbs of this specimen are represented in the accompanying figure. *Hawkins Collection. Purchased*, 1834.

14565. (*Fig.*) Slab exhibiting an oblique view of the dorsal and left lateral aspects of a large skeleton; from the Lower Lias of Street. Figured by Hawkins, *op. cit.* pl. xx. The skull and both pectoral limbs are almost perfect; but only the left one of the pelvic limbs remains. There are five rows of phalangeals in the pectoral paddle. The notch in the tibiale is well shown; and there are four bones in the second row of the tarsus. *Hawkins Collection.*

14567. Slab exhibiting the ventral aspect of a large but slightly (*Fig.*) imperfect skeleton; from Street. Figured by Hawkins, *op. cit.* pl. xxi.; and the pelvic and caudal region by Owen in the 'Trans. Geol. Soc.' ser. 2, vol. v. pl. xlii. The right pectoral paddle is well preserved, and has six rows of phalangeals. *Hawkins Collection.*

Fig. 23.



Ichthyosaurus intermedius.—Dorsal aspect of the right pectoral and pelvic limbs of No. 2013*. $\frac{1}{3}$. *h*, humerus; *r*, radius; *u*, ulna; r^1, radiale; *i*, intermedium; u^1, ulnare; c^1, c^2, centralia; *t*, tibia; *f*, fibula; t^1, tibiale; f^1, fibulare. The small bone between *u* and u^1 is identified by Baur with the pisiform.

2013 * a. Slab showing the left lateral aspect of a rather smaller (*Fig.*) but nearly entire skeleton; from Street. The pelvic and caudal region is figured by Owen in the 'Trans. Geol. Soc.' ser. 2, vol. v. pl. xlii. The paddles of the left side are fairly well preserved; and the frontal aspect of the skull is also shown. A fourth bone is partially thrust up into the

second tarsal row; and the middle phalangeals of the first row of the pectoral paddle are notched.

Hawkins Collection.

R. 1213. Slab showing the ventral aspect of an imperfect skeleton, exhibiting all the characters of this species; from Street. The mandible and pectoral paddles are shown, but the pelvic limbs are wanting. The pectoral paddles are broad, and show the characteristic notches in the anterior border of the middle phalangeals of the first row.

Hawkins Collection.

14563. Slab showing an imperfect skeleton, apparently belonging to this species; probably from Lyme-Regis. The right lateral aspect of the caudal region is well preserved; but the anterior part of the skeleton is broken. The ventral aspect of the mandible is shown. The characteristic notch in the tibiale is shown. *Hawkins Collection.*

R. 1214. Slab showing the crushed skull and pectoral girdle and limbs of a skeleton, probably referable to the present species; from Street. *Hawkins Collection.*

2017 *. (*Fig.*) Slab exhibiting the ventral aspect of a small incomplete skeleton; from Street. Figured by Hawkins in his 'Sea Dragons,' pl. xxiii. The limbs are preserved, but the skull is crushed, and the dorsal and the greater part of the caudal region of the vertebral column is wanting.

Hawkins Collection.

R. 44. (*Fig.*) Slab showing the right lateral aspect of the nearly entire skeleton of a comparatively small individual of this species; probably from Street. The skull, although crushed, is fairly preserved; and the four limbs are also shown, but both the pelvic ones are imperfect. The right columella is described and figured by A. Smith Woodward in the 'Proc. Zool. Soc.' 1886, pp. 406, 407 (woodcut, fig. 2). In the pelvic limb, which has been thrown in advance of the pectoral girdle, the notch in the tibiale is distinctly shown. The ventral aspect of the two coracoids in their natural position is exhibited. *Purchased*, 1881.

8165. Slab showing the dorsal and part of the left lateral aspect of a medium-sized imperfect skeleton; from Street. The head is bent round towards the tail. The anterior portion of the skull and the greater part of the caudal region are wanting. The four paddles are shown in fairly good

preservation. The middle portion of the vertebral column has been cut and polished in order to exhibit a vertical section. There are six longitudinal rows of phalangeals in the pectoral limb; the anterior border of some of those in the first row being notched. The pelvic paddle has the usual notches on the anterior border. This specimen is noticed on p. 374 of Mantell's 'Petrifactions,' where it is stated that the limbs were originally covered with carbonised integument. *Mantell Collection. Purchased*, 1838.

R. 1080. Slab showing the oblique dorsal and right lateral aspects of the anterior portion of a skeleton provisionally referred to this species; probably from Street. The greater portion of the skull and the cervico-dorsal vertebral region are well preserved, but the limbs are wanting. The skull apparently agrees with that of the present species; while the shortness of the spines of the vertebræ distinguishes the specimen from *I. communis*. *No history.*

2024 *. (*Fig.*) Slab showing a considerable portion of the dorsal region of the vertebral column, numerous ribs, the imperfect right pelvic limb, and the left femur; from Street. The vertebral column is broken up, and the arches are mostly separated from the centra. The characteristic notch in the anterior border of the tibiale is shown in the right limb. Figured in Hawkins's 'Memoirs on Ichthyosauri &c.' pl. xx. *Hawkins Collection.*

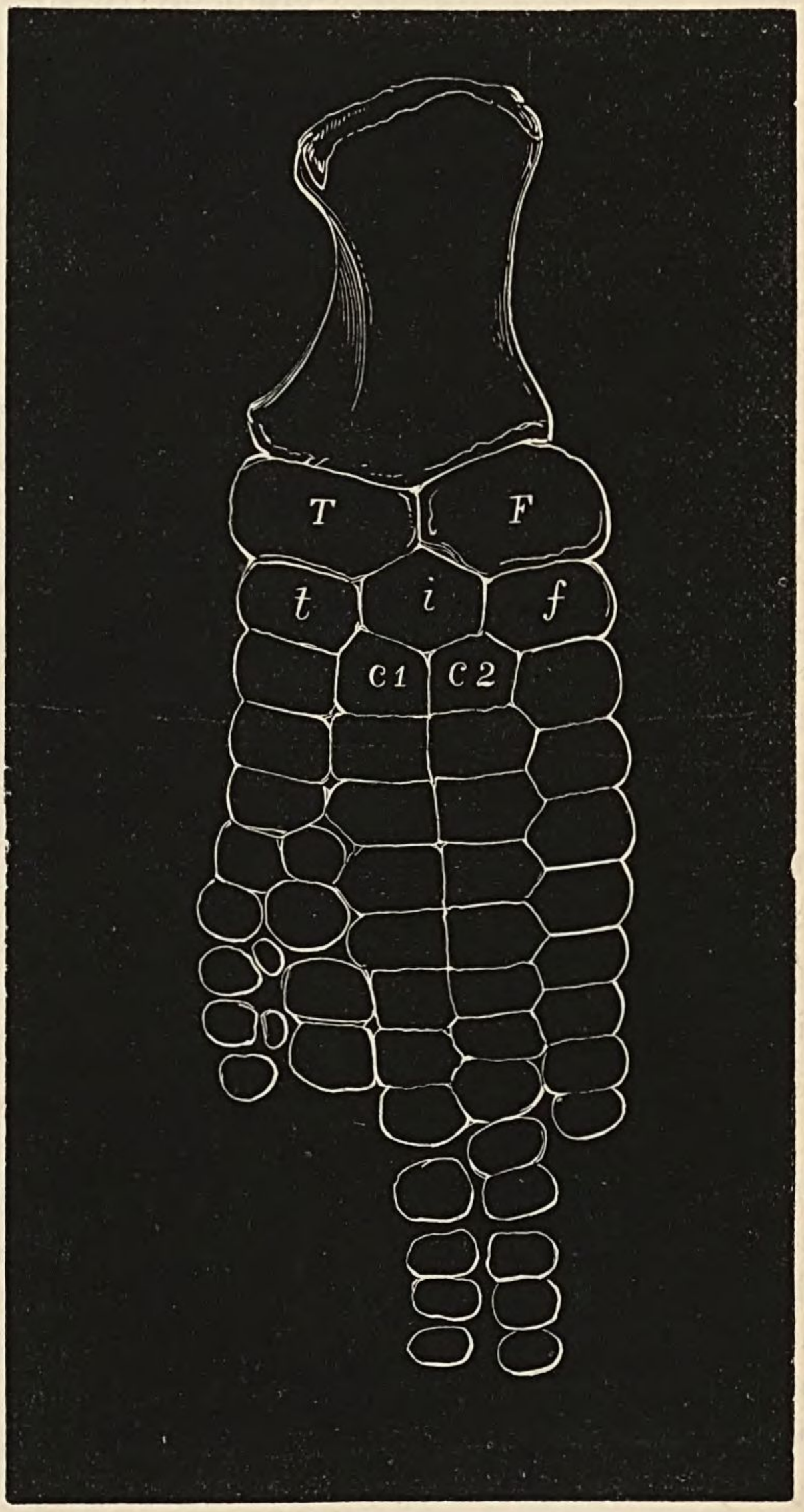
R. 1067. Slab showing the dorsal aspect of part of the vertebral column and pectoral girdle and limbs in a somewhat disturbed condition; from Street. The paddles present all the characteristic features of the present species.
(?) *Hawkins Collection.*

R. 288. Slab exhibiting the ventral aspect of the pectoral girdle and limbs of a medium-sized individual; probably from Street. All the bones of the pectoral girdle are perfect, and but slightly displaced. The limbs have been bent over towards the anterior aspect, and their terminal phalangeals are displaced. The paddles are narrow, and have five longitudinal rows.
Egerton Collection. Purchased, 1882.

R. 1070. Slab exhibiting the ventral aspect of the pectoral girdle and limbs, together with a number of detached teeth, bones of the pelvic girdle, and other parts of the skeleton;

from Street. This specimen belongs to a larger individual than the preceding. The bones of the pectoral girdle are displaced, and the extremities of the paddles are broken up. The left scapula and limb have been thrown away from the coracoid, towards the posterior extremity of

Fig. 24.



Ichthyosaurus intermedius.—Ventral aspect of the right pectoral limb, somewhat imperfect; from the Lias of Street. Reduced. T, radius; F, ulna; *t*, radiale; *i*, intermedium; *f*, ulnare; c^1, c^2, centralia. The posterior marginal row is wanting. (From the 'Proc. Geol. Soc.')

the body. Some of the first rows of phalangeals are notched anteriorly. *No history.*

14568. The nearly entire right pectoral limb; from Street. Figured (*Fig.*) by Hawkins in his 'Sea Dragons,' pl. xxii.; and by Hulke in the 'Proc. Geol. Soc.' 1883, p. 56, fig. 10 (as a pelvic limb); the latter figure being reproduced in the accompanying woodcut. This specimen, which has lost the posterior row of small ossicles, agrees closely with the larger pectoral limb of No. 14565 (p. 56); the ventral aspect is exposed. *Hawkins Collection.*

2099 *. The imperfect right pectoral paddle; from Lyme-Regis. The humerus, ulnare, and most of the ulnar phalangeals are wanting. This specimen agrees closely with the pectoral limb of No. 2013* (p. 57). *Hawkins Collection.*

2025 *. Slab showing the dorsal aspect of the caudal region of the (*Fig.*) vertebral column and the imperfect pelvic limbs; from Street. Figured by Hawkins in his 'Memoirs on Ichthyosauri &c.' pl. xxi.; and also by Owen in the 'Trans. Geol. Soc.' ser. 2, vol. v. pl. xlii. This specimen belongs to a medium-sized individual. The right limb is nearly entire, and exhibits the notch in the anterior border of the tibiale and adjacent tarsale. The greater part of the left paddle is wanting. *Hawkins Collection.*

R. 1061. Slab showing a small right pelvic paddle in a somewhat crushed condition; from Street. The notch in the tibiale and adjacent tarsale is well shown; and in having four bones in the second row of the tarsus this specimen agrees with the pectoral limb of the skeleton, No. 14565.

No history.

33595. A very well preserved skull, slightly crushed laterally, probably belonging either to the present or following species; from Lyme-Regis. The upper and lower jaws are separated; and the sclerotic and teeth are beautifully preserved. The teeth are small and slender. The length of the cranium is 0,258. *Purchased*, 1859.

Ichthyosaurus, sp.

The following specimens appear to come nearest to *I. intermedius*, but the anterior margin of the first row of phalangeals in the pectoral limb is entire.

Hab. Europe (England).

R. 1118. Slab exhibiting the right lateral aspect of the imperfect skeleton of a comparatively small individual; probably from the Lower Lias of Lyme-Regis, Dorsetshire. All the vertebral column is preserved, but the centra in the caudal region are displaced. The skull appears to have been comparatively short, but its component bones are separated; the teeth are slender. The bones of the pectoral girdle are in much confusion; but the ventral aspect of the left pectoral limb is well displayed. There are five longitudinal rows of phalangeals in the middle of this paddle. The two femora are preserved. *No history.*

R. 588. Slab exhibiting the ventral aspect of a right pectoral limb, agreeing very closely with that of the preceding specimen; from Lyme-Regis. This specimen is peculiar in having only three bones in the third row from the humerus.
Purchased, 1885.

33277. Slab exhibiting the left lateral aspect of a small skeleton, apparently agreeing very closely with No. R. 1118; from Lyme-Regis. The rostral region of the skull is finely preserved, and there are parts of the vertebral column and many of the ribs. The ventral aspect of the right humerus and radius is also shown. *Purchased*, 1858.

Ichthyosaurus, sp.

The following specimen is characterized by the elongated skull, excessive flatness of the terminal faces of the vertebral centra, and the elongation of the coracoid. It may indicate a distinct species.

Hab. Europe (England).

30877. Slab showing the left lateral aspect of the skull and anterior portion of the thoracic region of a young individual; from the Lower Lias of Lyme-Regis, Dorsetshire. The nearly entire left pectoral paddle is preserved, and is of relatively small size; its length being less than one third of that of the skull. *Purchased. About* 1853.

Specifically Undetermined Specimens from the Lias.

Of the undetermined skulls the majority appear to belong either to I. communis *or to* I. intermedius, *the presumption being that the larger number of those from Lyme-Regis are referable to the former, and those from Street to the latter species. Some may, however, possibly belong to the next group. The bones of the limbs are all referable to the present group.*

2026*. (*Fig.*) Slab showing a quadrate, vertebræ, ribs, interclavicle, scapula, humerus, femur, and detached bones of the pectoral limb; probably from the Lower Lias of Street, Somersetshire. Figured by Hawkins in his 'Memoirs on Ichthyosauri &c.' pl. xii. It is highly probable that this specimen belongs to *I. intermedius*.

Hawkins Collection. Purchased, 1834.

2002*. (*Fig.*) Slab showing the left lateral aspect of the imperfect anterior portion of a skeleton; from the Lower Lias of Street. The skull has lost the extremity of the rostrum, and is otherwise somewhat damaged; it exhibits the sclerotic bones and the preorbital vacuity, and has moderately large teeth. The first fifteen vertebræ and several of the ribs are preserved in an imperfect condition. Part of the pectoral girdle, together with the dorsal aspect of the left humerus, radius, and ulna, are also shown. Hawkins refers this specimen to *I. communis* (*chiropolyostinus*), and figures it in pl. ix. of his 'Sea Dragons.'

Hawkins Collection.

2006*. (*Fig.*) Slab showing the rostrum of the skull, together with a scapula, an imperfect coracoid, and a humerus; from Street. Figured by Hawkins in his 'Memoirs on Ichthyosauri &c.' pl. x.; the figure indicating that the specimen was less imperfect than at present. The relatively large size of the teeth indicates the probability of this specimen belonging to *I. communis*. *Hawkins Collection.*

41160. Slab showing the left lateral aspect of the skull, and the left scapula and pectoral limb of a very young individual; from Lyme-Regis. The limb has seven longitudinal rows of phalangeals, and shows all the characters of *I. communis*.

Purchased, 1868.

R. 1075. Slab showing the left side of the rostrum of a skull, together with detached vertebral centra and other bones;

from Street. The teeth are smaller than in the preceding specimen. *Hawkins Collection.*

R. 1076. Slab exhibiting the ventral and right lateral aspect of the rostrum of a skull and a few of the bones of the paddle; from Street. The small size of the teeth indicates that this specimen probably belongs to *I. intermedius*. *Hawkins Collection.*

R. 1077. Slab showing the right lateral aspect of an imperfect skull, together with the right scapula and four bones of the pectoral paddle, probably from the Lower Lias of Lyme-Regis, Dorsetshire. The orbital region is crushed; but the greater part of the rostrum is fairly well preserved. The teeth are of comparatively large size. *Hawkins Collection.*

33279. Slab showing the right lateral and part of the ventral aspect of a slightly larger, but otherwise very similar skull; from Lyme-Regis. The brain-case is much crushed. A few vertebral centra are also shown. *Purchased*, 1858.

2016 *. (*Fig.*) Slab showing the left lateral aspect of the rostrum of a skull; from Street. Figured by Hawkins in his 'Sea Dragons,' pl. xix. fig. 2. *Hawkins Collection.*

2015 *. (*Fig.*) Slab exhibiting the frontal aspect of a small crushed skull, wanting the extremity of the rostrum. Figured by Hawkins, *op. cit.* pl. xix. fig. 1; and the columella described and figured by A. Smith Woodward in the 'Proc. Zool. Soc.' 1886, pp. 407, 408, woodcut fig. 3. *Hawkins Collection.*

2010 *. (*Fig.*) Slab exhibiting the ventral aspect of a small rostrum, provisionally referred to the present group; from Street. Figured by Hawkins, *op. cit.* pl. xiv. fig. 1. *Hawkins Collection.*

R. 1078. Slab exhibiting the frontal aspect of a small crushed skull; locality unknown. *Hawkins Collection.*

R. 1079. Slab showing the left lateral aspect of a somewhat crushed skull, together with a scapula, vertebræ, and a few bones of the paddle; from Street. This specimen is probably referable to *I. intermedius*. *No history.*

39845. Slab exhibiting part of the frontal and part of the right lateral aspect of a small skull, together with a few vertebral centra; from Lyme-Regis. *Purchased*, 1866.

33281. Slab showing part of the frontal and part of the right lateral aspect of a crushed skull, together with six cervical vertebræ; from Lyme-Regis. The skull has relatively small teeth, and agrees in size with that of the skeleton (No. 1065, p. 53) referred to *I. conybeari*. The neural spines of the vertebræ are of moderate height. This specimen probably belongs either to *I. intermedius* or to the above-mentioned form. *Purchased*, 1858.

2014*. (*Fig.*) An imperfect skull, which has been vertically crushed; from Street. Figured by Hawkins in his 'Sea Dragons,' pl. xviii. The frontal region, the rostrum, and the entire mandible are fairly well preserved. The teeth are of medium size. *Hawkins Collection.*

2007*. (*Fig.*) Slab exhibiting the ventral aspect of an imperfect rostrum; from Street. Figured by Hawkins, *op. cit.* pl. xi. The teeth are of comparatively large size. *Hawkins Collection.*

2005*. (*Fig.*) Slab showing the ventral aspect of an imperfect skull, together with a few vertebral centra; from the Lower Lias near Bristol. Figured by Hawkins, *op. cit.* pl. viii. The rostrum and teeth are well preserved, the latter being of rather small size. *Hawkins Collection.*

R. 1081. Slab showing the ventral aspect of an imperfect mandible, together with a vertebral centrum and a rib; from Street. *No history.*

R. 1082. The rostral portion of a skull; from Lyme-Regis. The teeth are rather small. *No history.*

2010*. (*Fig.*) Slab showing the left lateral aspect of the rostral portion of the skull of a small individual; from Street. Figured by Hawkins in his 'Sea Dragons,' pl. xiv. fig. 2. The teeth are of medium size. *Hawkins Collection.*

2089*. Slab showing the frontal and right lateral aspects of the rostrum of a small individual; from Street. The teeth, which are of medium size, are somewhat displaced. *Hawkins Collection.*

R. 1083. Slab exhibiting the frontal and lateral aspects of a medium-sized rostrum; probably from Street. The teeth are somewhat damaged, but show all the characters of those of *I. intermedius*. *No history.*

R. 1084. The middle portion of a rostrum; probably from Lyme-Regis. The teeth are larger than in the preceding, and indicate that this specimen may belong to *I. communis*.
No history.

2090*. The orbital region of a medium-sized skull; from Lyme-Regis. The frontal region, the parietal foramen, and right supratemporal fossa, orbit, and narial aperture are well exhibited. The few teeth remaining appear to be of the type of *I. communis*, to which species it is very probable that the specimen should be referred. *Hawkins Collection.*

At least the majority of the following specimens belong to this Group.

R. 1176. A right scapula; probably from Street. This specimen cannot be distinguished from the corresponding bone of *I. intermedius*. *No history.*

R. 1177. A right scapula of similar dimensions, but with a narrower distal extremity; probably from Street. *No history.*

R. 1178. A smaller right scapula; probably from Street.
No history.

R. 1179. A similar specimen; probably from Street. *No history.*

R. 1180. A considerably smaller right scapula; probably from Street. *No history.*

R. 1181. Slab showing the dorsal aspect of a similar right scapula; from Street. *No history.*

R. 1182. A left scapula, agreeing in size with No. R. 1178; locality unknown. *No history.*

R. 1183. Slab showing the dorsal aspect of a very similar left scapula; probably from Street. *No history.*

R. 267 c. A left scapula, nearly equal in size to the preceding, but relatively narrower; from Lyme-Regis. This specimen probably belongs to *I. communis*.
Egerton Collection. Purchased, 1882.

R. 267 d. Slab showing the dorsal aspect of a smaller left scapula of similar type; from Lyme-Regis. This specimen closely resembles the corresponding bone of the skeleton of *I. communis*, No. R. 1162. *Egerton Collection.*

25410. Slab showing the dorsal aspect of a medium-sized right scapula, perhaps referable to this group; from the Lower Lias of Glastonbury, Somersetshire. *Purchased*, 1850.

R. 217. Slab showing the imperfect pectoral girdle of a medium-sized individual; from Lyme-Regis. The left scapula is seen from the dorsal, and the right from the ventral aspect; the corresponding surfaces of the two coracoids being also exposed. In the slender scapula and deep notches to the coracoid this specimen agrees with *I. communis*. *Presented by F. Seymour Haden, Esq.*, 1882.

R. 1184. Slab showing the ventral aspects of the coracoids and of one scapula, together with teeth and several bones of the pectoral paddle; apparently from Street. This specimen probably belonged to a full-sized individual of *I. intermedius*. *No history.*

R. 1185. An imperfect left coracoid of similar size and type; probably from Street. *No history.*

R. 1186. A rather smaller and slightly imperfect left coracoid; not improbably from Lyme-Regis. *No history.*

R. 1187. A small and imperfect right coracoid; locality uncertain. In its longer anterior notch this specimen resembles *I. communis*. *No history.*

2125*. Slab showing the ventral aspect of a smaller left coracoid; probably from Street. Closely resembles the corresponding specimen in the pectoral girdle of *I. intermedius*, No. R. 288 (p. 59). *Hawkins Collection.*

2127*. Slab showing the dorsal aspect of a very similar right coracoid; probably from Street. *Hawkins Collection.*

R. 1188. Fragment of shale showing the dorsal aspect of the left and a portion of that of the right coracoid of a smaller individual; locality unknown. *No history.*

R. 666. (*Fig.*) The left humerus of a medium-sized individual; from Lyme-Regis. This specimen not improbably belongs to *I. communis*; and is represented in fig. 17, p. 40. It has suffered slightly by flattening. *Presented by J. E. Lee, Esq.*, 1885.

R. 1031. A rather smaller left humerus of similar general type; locality unknown. *No history.*

R. 1032. A left humerus of rather larger size than No. R. 666; locality unknown. *No history.*

R. 1033. A slightly larger and relatively narrower left humerus; locality unknown. *No history.*

2095*. A right humerus closely resembling the preceding specimen; locality unknown. *Hawkins Collection.*

R. 1034. A left humerus of a rather more slender type; locality unknown. *No history.*

R. 1035. A considerably larger left humerus, with the radial facet imperfect; locality unknown. *No history.*

R. 1036. A larger left humerus, with the radius in apposition; probably from Street. This specimen agrees precisely with the corresponding bones of the larger skeletons of *I. intermedius*, and probably belongs to that species. The terminal caudal vertebræ and some other bones are attached to the ventral aspect of the humerus. *No history.*

R. 1037. An associated right and left humerus of similar type; locality unknown. The dorsal aspect of these specimens is obscured by matrix. *No history.*

R. 1038. A rather smaller right humerus; locality unknown. *No history.*

R. 1039. A smaller left humerus; locality unknown. In contour closely resembles No. R. 666. *No history.*

R. 1039 a. A left radius; probably from Street. Indistinguishable from the corresponding bone of *I. intermedius*. *No history.*

R. 666 a. Two specimens of the humerus of very small individuals; from Lyme-Regis. *Presented by J. E. Lee, Esq.*, 1885.

2100*. Slab showing an ischium and pubis; from Lyme-Regis or Street. The elongated form of these bones is well shown. *Hawkins Collection.*

2121*. Slab showing an ischium and pubis and a vertebral centrum; from Lyme-Regis or Street. *Same history.*

2140*. Slab showing an ischium and pubis; from Lyme-Regis or Street. *Same history.*

2140* a. Slab showing a larger ischium and pubis, and some of the bones of a paddle; from Lyme-Regis or Street. *Same history.*

44175. A medium-sized right femur; probably from Street. This specimen, which is represented in woodcut fig. 18 (p. 41), is probably referable to *I. intermedius*, since it cannot be distinguished from the corresponding bone in the skeletons of that species. *No history.*

R. 1130. A rather smaller right femur; probably from Street. *No history.*

40123. A left femur, with the tibia and fibula in apposition; from Lyme-Regis. The contour of this specimen differs from that of the preceding specimens; it is probably referable to *I. communis*. *Purchased.*

44175 a. A smaller left femur agreeing in contour with No. 44175; probably from Street. *No history.*

44175 b. A similar specimen; probably from Street. *No history.*

2093*. A small right femur; from Street (?). *Hawkins Collection.*

2094*. A smaller right femur; from Lyme-Regis (?). *Same history.*

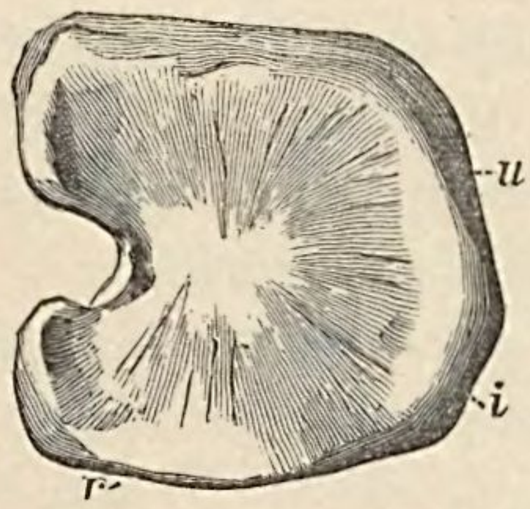
2092*. A small left femur; from Lyme-Regis (?). *Same history.*

44175 c. A small left femur; locality unknown. *No history.*

B. Longipinnate Group [1].

Orbit relatively large. Teeth with either fluted and cylindrical, or compressed and carinated crowns, and their roots either fluted or invested with a nearly smooth coat of cement; frequently spaced

Fig. 25.



Ichthyosaurus tenuirostris.—Dorsal aspect of the left radius; from the Lower Lias of Lyme-Regis. ½. *u*, facet for ulna; *i*, do. for intermedium; *r'*, do. for radiale.

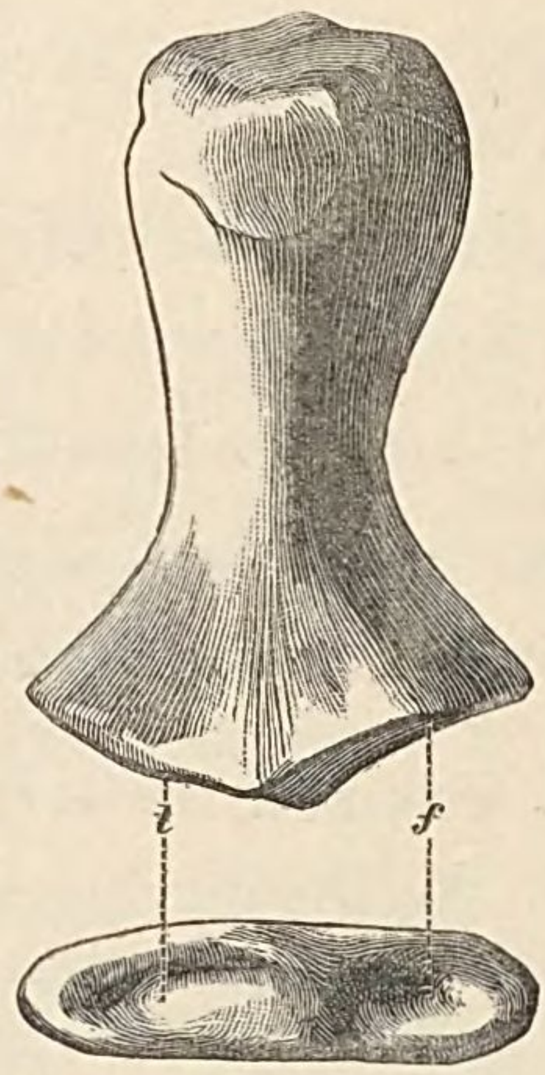
and often small. Pectoral limb (figs. 27, 32) with the third digit, or that arising from the intermedium, comprising only a single longitudinal row of bones, and consequently only one centrale;

[1] See note, p. 13.

usually only four longitudinal rows of phalangeals in this limb, and the radius (fig. 25) nearly square, with its anterior border notched. Occasionally a small vacuity between radius and ulna. In some cases pectoral limb scarcely larger than pelvic, and both of great relative length. Neural spines of dorsal vertebræ more or less low and wide.

The cranial rostrum is frequently much elongated. The femur (fig. 26) is nearly symmetrical, long and narrow, without a distinct trochanteric ridge, and with considerable expansion of the distal extremity. In the humerus the proximal extremity may either

Fig. 26.



Ichthyosaurus (*cf.*) *tenuirostris*.—Dorsal and distal aspects of the left femur; from the Lias of Street. *t*, tibial, *f*, fibular facet.

have an oblong contour with the longer axis placed antero-posteriorly (*i. e.* parallel to the longer axis of the distal surface), or a subtriangular contour, with the longer axis transverse. Its distal extremity is usually much expanded.

This group is unknown above the Lias, and its more generalized species connect the Latipinnate group with *Mixosaurus*. The affinities with the latter are shown by the contour of the radius and tibia, and the occasional presence of a small vacuity between the radius and ulna.

Were it not for the difficulty of explaining the presence of the same feature in the carpals and tarsals, the notch in the anterior border of the radiale, tibiale, and phalangeals might be regarded as the last trace of the shaft of a "long bone"; and it is by no means certain that this interpretation may not really prove to be the true one.

a. *Acutirostrine Subgroup.*

Teeth comparatively small, with cylindrical and fluted crowns and roots. Mandible with superior border of articular bone considerably above the level of the alveolar border of the dentary. Centra of cervical vertebræ subcordiform and pentangular, and those of posterior dorsals and anterior caudals narrowed superiorly; upper costal tubercles of cervicals partly supported on the arch. Coracoid without posterior notch. Humerus with the proximal extremity oblong, and the longer axis of the same directed antero-posteriorly. Pectoral limb larger than pelvic.

In the characters of the vertebræ and coracoid, this subgroup appears allied to the Campylodont subgroup; and in some forms the scapula is of the type of the latter.

Ichthyosaurus integer, Bronn[1].

The notch in the radius wanting, and that in the radiale either very slight or absent; transverse diameter of the radius considerably longer than the vertical; component bones not large; and first row of ulnar phalangeals oblong. Anterior notch of coracoid very small, or absent.

This species, of which the type specimen was obtained from the Upper Lias of Würtemberg, was referred by Wagner, and subsequently by Kiprijanoff, to the Latipinnate group; but the structure of the pectoral paddle clearly shows that it belongs to the present group, which it connects with the former. The type specimens indicate a comparatively small form, which was probably closely allied to the next species.

Hab. Europe (Würtemberg and [?] England).

47409. A considerable portion of the skeleton of a small Ichthyosaur belonging either to this or a closely allied form; from the Upper Lias of Kingsthorpe, Yorkshire. The portions remaining comprise fragments of the skull, a large number of vertebral centra, one coracoid, portions of the pectoral limbs, and a femur. Of the right pectoral limb there remains the entire humerus, with the radius, ulna, radiale, intermedium, ulnare, and the two middle bones of the next row in apposition, together with a portion of the phalangeals. This specimen accords so closely with the right pectoral limb figured by Wagner in 'Abh. k.-bay. Ak. Wiss.' vol. vi. pt. 2, pl. xvi. fig. 1, as to leave little doubt as to the specific identity of the two. In both the radius

[1] Neues Jahrb. 1844, p. 679.

has an entire anterior border, and the ulnare has a peculiar polygonal contour and oblique position which is very characteristic. The radiale has a very small notch in the anterior border. The coracoid shows a small anterior notch, of which there is only a trace in the specimen figured by Wagner; but its size may have been somewhat increased by pressure. The femur is totally different from that of *I. communis* and its allies, and approximates to that of *I. tenuirostris* (fig. 26).

Sharp Collection. Purchased, 1876.

Ichthyosaurus, sp.

The following Lower Liassic specimens indicate a form allied either to *I. integer* or to *I. acutirostris*.

Hab. Europe (England).

33178. Slab exhibiting the dorsal aspect of a medium-sized left pectoral limb, agreeing in general characters with the one noticed under the head of *I. integer*; from the Lower Lias, probably of Barrow-on-Soar, Leicestershire. The radius and the other bones of the anterior border have a small marginal notch. *Purchased. About* 1844.

28327. A pair of crushed coracoids, not improbably specifically identical with the preceding; from the Lower Lias of Lyme-Regis, Dorsetshire. With the exception of having a rather deeper anterior notch, these specimens closely resemble the coracoid of *I. integer* figured by Wagner in the 'Abh. k.-bay. Ak. Wiss.' vol. vi. pt. 2, pl. xvi. fig. 1.

Purchased, 1853.

R. 269 a. A rather larger right coracoid of apparently the same type as the preceding; from Lyme-Regis.

Egerton Collection. Purchased, 1882.

49203. A skull apparently belonging to the present group, but differing from those of all named species, and therefore perhaps belonging to the present form; from the Lower Lias of Lyme-Regis. The hyoids are shown; and a mass of matrix attached to the occiput contains a scapula, the atlas and axis, and several other vertebral centra; the latter are subpentagonal and cordiform and deeply cupped. A vertical crush has elongated the orbit in an antero-posterior direction; but the sclerotic ossifications are beautifully preserved. The relatively large orbits and

the flattening of the nasals, as well as the cordiform cervical vertebræ, apparently indicate that this specimen belongs to the present group. The teeth are small. The rostrum is shorter than in *I. tenuirostris*, and the flattening of the nasals and the smaller orbit also distinguish this skull from that species. The contour of the mandible differs from that of *I. lonchiodon*, and the cupping of the vertebral centra is deeper. The articular bones of the mandible are *in situ*. In size this specimen agrees nearly with the skull of *I. tenuirostris*, No. R. 1126.

Presented by the Rev. T. S. Montefiore, 1878.

R. 1168. The posterior portion of a smaller skull specifically indistinguishable from the preceding; from Lyme-Regis. This specimen has been only slightly crushed; the characteristic flattening of the nasals is well shown. Both sclerotic ossifications are well preserved, and the posterior teeth remain.

No history.

Ichthyosaurus acutirostris, Owen[1].

Syn. *Ichthyosaurus longipinnis*, Mantell[2] (*in parte*).
(?) *Ichthyosaurus microdon*, Wagner[3].
(?) *Ichthyosaurus quadriscissus*, Quenstedt[4] (*in parte*).

Closely allied to the next species, but distinguished by the curved rostrum and the shorter supratemporal fossæ. In the rostrum the alveolar border of the premaxilla is concave, and that of the dentary convex.

The skeletons of Ichthyosaurs from Würtemberg containing fœtuses figured by Seeley in the 'Rep. Brit. Assoc.' for 1880, pl. i., apparently belong to this species, and probably correspond to *I. quadriscissus* of Quenstedt (see No. R. 971). *I. microdon*, from Würtemberg, was subsequently identified by its describer as a variety of *I. acutirostris*.

This species is confined to the Upper Lias.

Hab. Europe (England and Germany).

14553. (*Fig.*) Slab showing the right lateral aspect of the skull, a coracoid, the pectoral limbs, of which one is entire, and other fragments of the anterior part of the skeleton of a large

[1] Rep. Brit. Assoc. for 1839, p. 121 (1840).
[2] Petrifactions and their Teachings, p. 378 (1851).
[3] Abh. k.-bay. Ak. Wiss. vol. vi. pt. 2, p. 509 (1851).
[4] Die Jura, p. 219 (1858). The name is merely given in the plural as that of a group, but has been subsequently quoted as a specific one.

individual; from the Upper Lias of Whitby, Yorkshire. The type. Noticed by Mantell in his 'Petrifactions,' p. 378, as *I. longipinnis*. Described, and the skull figured by Owen in his 'Liassic Reptilia' (Mon. Pal. Soc.), pt. iii. p. 121, pl. xxxii. fig. 8. The skull is fairly preserved, and exhibits very clearly the curvature of the alveolar borders of the rostrum; but the frontal surface is only very imperfectly shown. The pectoral paddle is remarkable for its extreme length; and has four longitudinal rows of phalangeals. The coracoid is of an elongated form, and shows the absence of a posterior notch; its contour appears to agree closely with that of the specimens No. 32669 (p. 81). *Purchased. About* 1840.

15500 a. Slab showing the frontal aspect of a large skull; from the Upper Lias of Whitby. Although somewhat crushed this specimen exhibits the characteristic ridges on the nasals and the moderately elongated supratemporal fossæ; the curvature of the rostrum is also shown. *Same history.*

39454. A young skull, in a somewhat damaged and distorted condition; from the Upper Lias of Whitby. This specimen agrees so closely with the skull of No. 14553 that there can be no doubt as to its specific identity. The characteristic curvature of the rostrum, moderately elongated supratemporal fossæ, and prominent ridges on the nasals are well shown. *Bowerbank Collection. Purchased*, 1865.

R. 792. The imperfect posterior portion of a somewhat larger skull; from the Upper Lias of Whitby. The frontal region and the right orbit (with its ossified sclerotic) are well preserved. The moderately elongated and triangular form of the right supratemporal fossa is shown; and the prominent lateral borders of the nasals are also well exhibited. The occipital region is wanting.

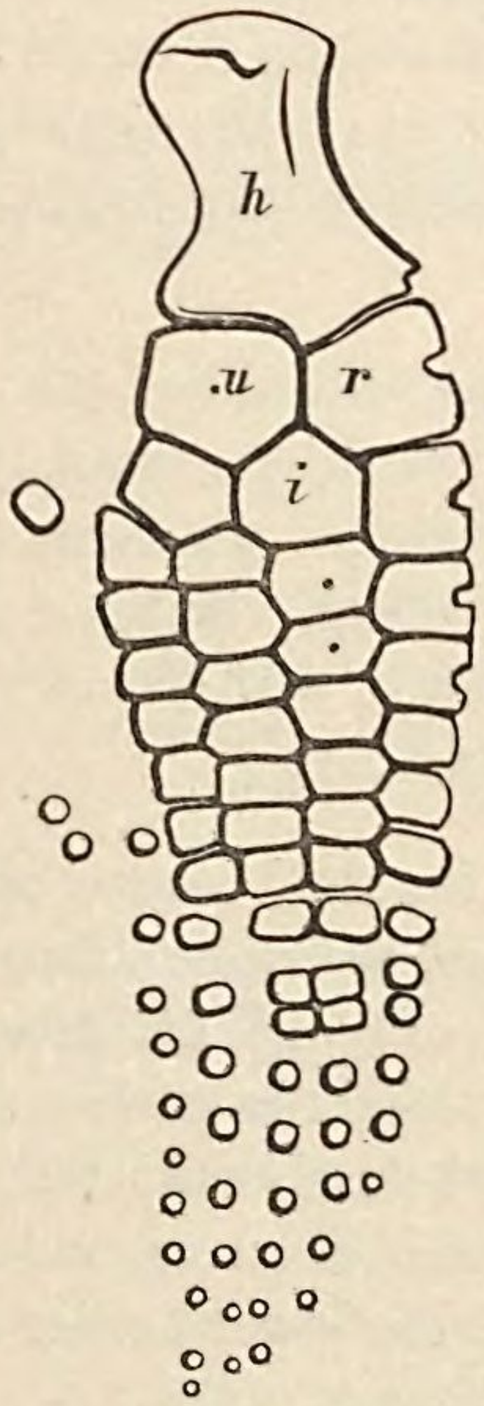
Presented by J. E. Lee, Esq., 1885.

The following specimens may belong either to this or the next species.

R. 971. (*Fig.*) Slab exhibiting the right lateral aspect of the nearly entire skeleton of a small individual; from the Upper Lias of Holzmaden, Würtemberg. The skull is much crushed, and one sclerotic ring has been entirely detached, and is shown from the inner aspect. The pectoral girdle is

fairly well preserved, and both limbs of the right side are nearly entire, but those of the left are broken up. The pectoral limb (fig. 27) agrees exactly with that of No. 14553, and also with that of *I. zetlandicus*, No. 32685, but has lost the terminal bones. The contour of the skull, so far as can be seen, appears to agree with that of the former. The coracoids, moreover, closely resemble those of *I. zetlandicus*, No. 32669, having the pointed posterior extremity. The entire skeleton agrees precisely with the larger one figured by Seeley in the 'Rep. Brit. Assoc.' for 1880, pl. i. fig. 3, with the exception that in

Fig. 27.



Ichthyosaurus (*cf.*) *acutirostris*.—Dorsal aspect of the right pectoral limb; from the Upper Lias of Würtemberg. *h*, humerus; *r*, radius; *u*, ulna; *i*, intermedium.

the latter there is no fifth row of phalangeals in the pectoral limb; but this row is shown in the specimen represented in fig. 2 of the same plate. Both these specimens show the curved rostrum characteristic of this species. The small skeleton figured by Renevier in the 'Bull. Soc. Vaud.' sér. 2, vol. xxi. pl. i. (1885), as *I. quadriscissus*, is also very similar to the present specimen. Theodori,

on p. 55 of his 'Beschreibung des *Ichthyosaurus trigonodon*,' refers most of the skeletons of Ichthyosaurs from the Upper Lias of Würtemberg and Banz in Bavaria to *I. acutirostris*, and a drawing by him in the Museum copy of that work of a skull from Banz shows the separation of the premaxilla and lachrymal beneath the nares characteristic of this and the next species. In the absence of the exact contour of the rostrum and the form of the supratemporal fossa, it is, however, impossible to determine to which of the two species these specimens belong. The strong ridge on the anterior border of the scapula is very apparent. *Purchased*, 1857.

R. 972. Slab showing the right lateral aspect of a smaller and nearly entire skeleton; from the Upper Lias of Holzmaden. The skull is crushed, the limbs have been somewhat dislocated, and the posterior caudal vertebræ are thrown out of place. *Same history.*

39489. Slab showing the ventral and part of the left lateral aspect of the crushed skull of a much larger individual, probably referable to this or the next species; from the Upper Lias of Würtemberg. So far as can be seen, this specimen agrees very closely with the sketch of a cranium by Theodori mentioned above. *Purchased*, 1864.

R. 1196. Slab showing the right lateral aspect of an imperfect skull of medium size, probably belonging to this species; from the Upper Lias of Boll, Würtemberg. The anterior cervical vertebræ still remain in position. The outline of the skull seems to accord closely with the above-mentioned drawing by Theodori; and, so far as can be determined, the maxilla seems to enter the lower border of the nares. *No history.*

Ichthyosaurus zetlandicus, Seeley [1].

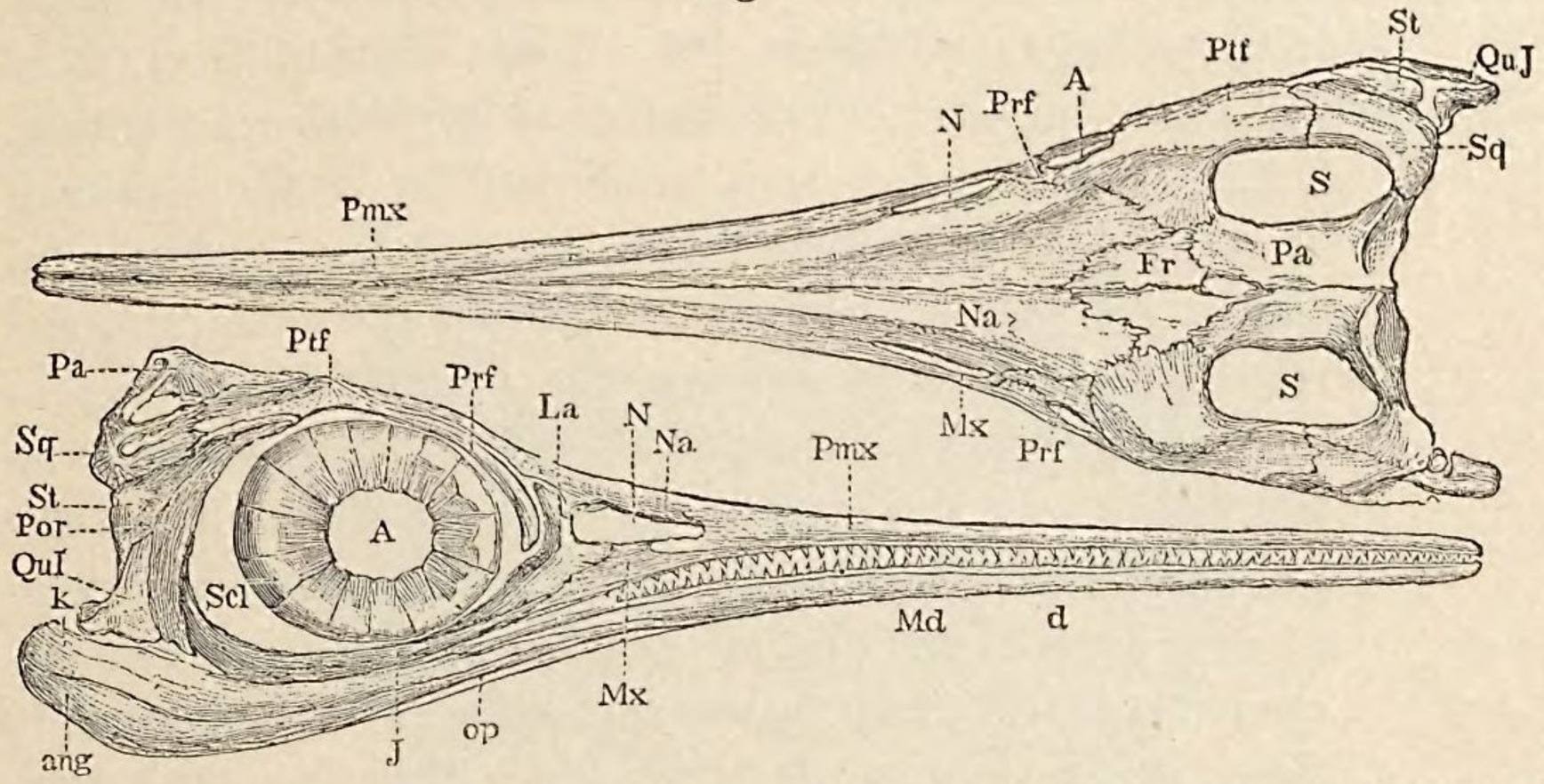
Syn. *Ichthyosaurus longifrons*, Owen [2].

Cranial rostrum straight and of moderate length and thickness (fig. 28); supratemporal fossæ (figs. 28, 29) long, large, and approaching the form of an isosceles triangle; fronto-nasal region long and narrow, with the median part of the nasals depressed and their

[1] Quart. Journ. Geol. Soc. vol. xxxvi. p. 635 (1880).
[2] Liassic Reptilia (Mon. Pal. Soc.), pt. iii. p. 118 (1881).

lateral borders raised into prominent ridges in advance of the orbits; maxilla forming middle of inferior border of narial aperture. Neural spines of dorsal vertebræ of considerable height; vertebral centra long and moderately cupped. Pectoral paddle (comp. fig. 27) long, with anterior border of radius, radiale, and adjacent carpale in second transverse row notched; component bones relatively large but

Fig. 28.



Ichthyosaurus zetlandicus.—Superior and right lateral aspects of the skull; from the Upper Lias of Normandy. Reduced. *Pmx*, premaxilla; *Mx*, maxilla; *N*, nares; *Na*, nasal; *Fr*, frontal; *Prf*, prefrontal; *Ptf*, postfrontal; *Pa*, parietal; *J*, jugal; *QuJ*, quadratojugal; *Sq*, squamosal; *St*, supratemporal; *Por*, postorbital; *A*, orbit; *S*, supratemporal fossa; *Scl*, sclerotic; *Md*, mandible; *d*, dentary; *op*, splenial; *ang*, angular; *k*, articular. (*After Zittel.*)

markedly polygonal, and the first longitudinal row of ulnar phalangeals distinctly oblong, with their longer diameter transverse. A small fifth row of phalangeals probably present in some cases. Coracoid (fig. 30) elongated antero-posteriorly; scapula of the general type of that of *I. platyodon* (*infrà*, p. 101).

The radius and ulna have no interval between them, and the former articulates by a large surface with the intermedium.

The only characters by which this form can be distinguished from *I. acutirostris* are the form of the rostrum and supratemporal fossæ. Although slight differences in the relations of the bones of the quadratic region are found in the crania described as *I. longifrons*, yet these forms are evidently so closely related that they may well be classed under one specific name. The pectoral limb of the so-called *I. longifrons* presents all the characters of that of *I. acutirostris*. If the form commonly described as *I. quadriscissus* belong to this rather than to the preceding species, that name has the priority, but its dubious authenticity (p. 73, note) is a bar to its adoption.

This species is confined to the Upper Lias, and attains dimensions nearly equal to *I. lonchiodon*.

Hab. Europe (England, France, and [?] Germany).

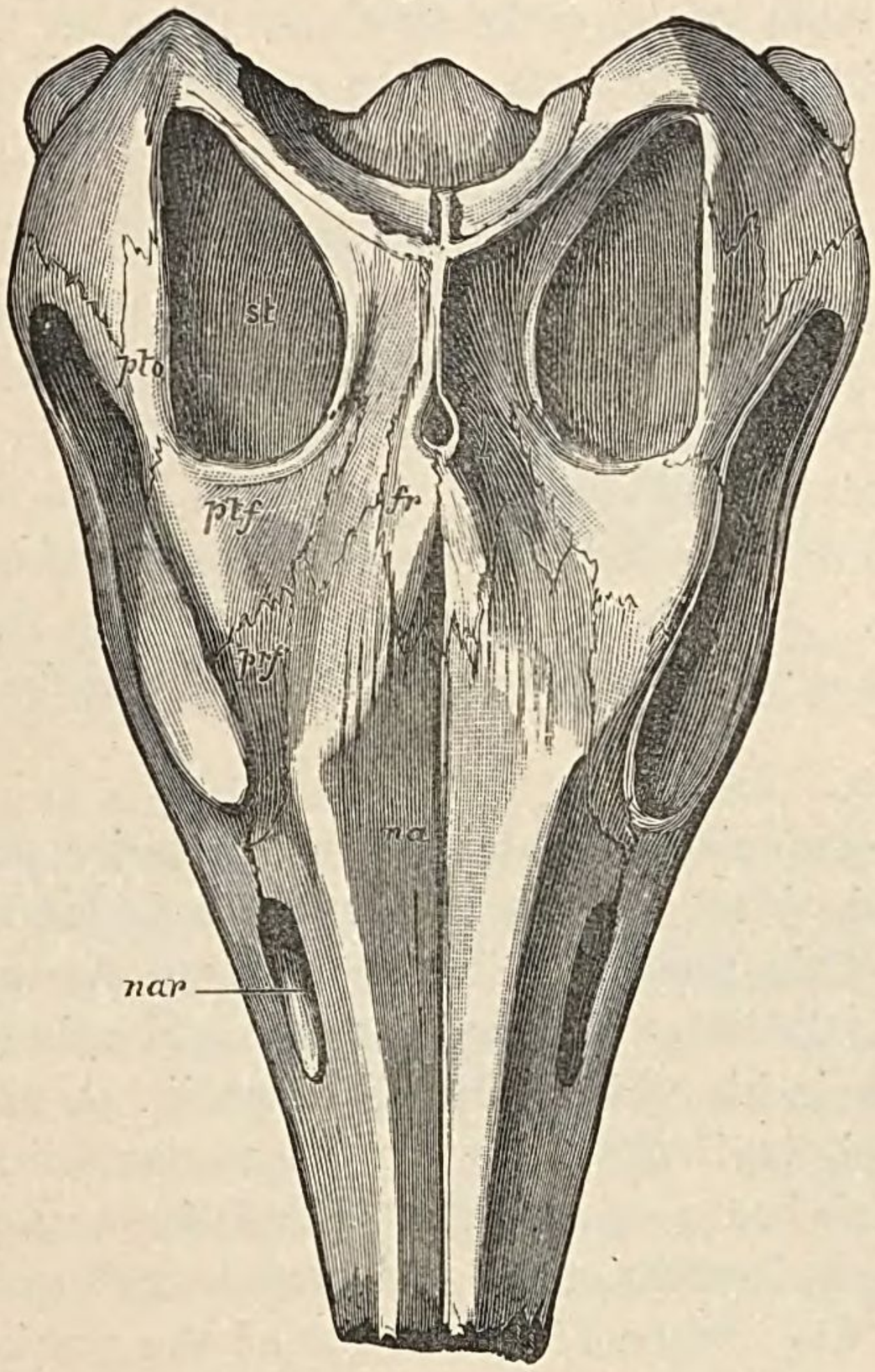
R. 1167. Cast of the cranium, wanting the extremity of the rostrum, of a very large individual. The original, which is the type, was obtained from the Upper Lias of Whitby, Yorkshire, and is preserved in the Woodwardian Museum at Cambridge. It is figured by Seeley in the 'Quart. Journ. Geol. Soc.' vol. xxxvi. pl. xxv. The crowns of the teeth are wanting, but the specimen has been unaffected by crush, although some displacements have taken place of the basioccipital and in the palatal region. Superiorly the quadratojugal runs up between and overlaps the postorbital and supratemporal (supraquadrate of Seeley) in a long point, so as to reach above the level of the superior extremity of the quadrate, while posteriorly and inferiorly the supratemporal overlaps the quadratojugal. The contour and arrangements of these bones are, indeed, very similar to those in Theodori's drawing of the Bavarian skull mentioned above (p. 76). On the palate the bones (*t*) identified in Seeley's figure with the transverse are really the palatines, and those termed palatines (*pn*) the vomers, while the apertures marked *Pt. V.*, and termed palatine vacuities, are the posterior nares. Although it is stated that the base of the skull is widely different from that of the next specimen, the two are really almost identical.

Made in the Museum, 1888.

33157. (*Fig.*) The nearly entire cranium of a half-grown individual, wanting the anterior portion of the rostrum, with the two articular bones; from the Upper Lias of Curcy, near Caen, Normandy. The type of *I. longifrons*. Figured by Owen in his 'Liassic Reptilia' (Mon. Pal. Soc.), pt. iii. pls. xxxiii.–xxxvi., a reduced view of the frontal aspect being shown in the accompanying woodcut. In all essential characters this specimen agrees with the preceding; and it is indistinguishable from the skull represented in fig. 28. The lateral surfaces of the orbital region have, however, been somewhat compressed, which makes the plane of the orbit less oblique; and the nasal ridges are rather less prominent. The quadratojugal only extends a short distance between the postorbital and supratemporal,

and its extremity is consequently considerably below the level of that of the quadrate, while there is no overlapping of the quadratojugal upon the supratemporal, or of the latter upon the posterior part of the former. These differences, however, can scarcely be regarded as of specific value; and the small skull No. 32682 seems to present a nearer resemblance in these points to the preceding specimen. In Owen's figure the articular bones of the mandible are represented as attached to the quadrates. The determination of the bones of the palate in that figure

Fig. 29.



Ichthyosaurus zetlandicus. — Frontal aspect of the imperfect cranium; from the Upper Lias of Normandy. $\frac{1}{3}$. *nar*, nares; *na*, nasals; *prf*, prefrontal; *fr*, frontal; *ptf*, postfrontal; *pto*, postorbital; *st*, supratemporal fossa.

requires revision; thus, those marked 20, and regarded as the palatines, are the vomers; while No. 25, which are reckoned as the ectopterygoids or transverse bones, are the palatines. The base of the skull is extremely like that of *Sphenodon*, showing the same subpyriform aperture

between the pterygoids, in the centre of which is the long styliform presphenoidal rostrum. The anterior processes of the pterygoids are very long and narrow, and articulate with the equally slender vomers, external to which are the posterior processes of the premaxillæ. This specimen is noticed by Seeley in the 'Quart. Journ. Geol. Soc.' vol. xxxvi. p. 642. *Tesson Collection. Purchased*, 1857.

32681. The hinder portion of a similar cranium, with the hinder part of the left ramus of the mandible attached; from the Upper Lias of Curcy. In the left orbit the original oblique contour is still retained, and the ridges on the nasals are more prominently developed than in the preceding specimen. The form of the quadratojugal seems to have been the same as in the latter. *Same history.*

32682. The hinder portion of a considerably smaller skull, in a somewhat crushed condition; from the Upper Lias of Curcy. The quadratojugal extended higher up between the postorbital and supratemporal than in No. 33157, reaching to the level of the summit of the quadrate, and more nearly resembling the arrangement obtaining in the type. In this specimen the premaxilla and lachrymal unite to shut out the maxilla from the narial aperture.
Same history.

32685. (*Fig.*) A mass of matrix containing the anterior portion of the vertebral column, the ribs, and a considerable portion of one of the pectoral limbs, belonging to the same individual as No. 33157. The conjoint atlas and axis are figured by Owen in his 'Liassic Reptilia,' pt. iii. pl. xxiii. figs. 2–5, and pl. xxvii. figs. 3–5; the impression being given that the two bones are separate. The tall neural spines and the elongated centra of the vertebræ are well shown. Of the limb the humerus is wanting, and the portion remaining has been bent over upon itself. The notch in the radius and first carpale of the second row is shown, but the radiale is wanting. There are four longitudinal rows of phalangeals; and the whole paddle, although imperfect distally, agrees precisely in all essential details with that of No. 14553 (p. 73). *Same history.*

32686. The centra and portions of the arches of twelve middle and posterior dorsal vertebræ, not improbably belonging to the

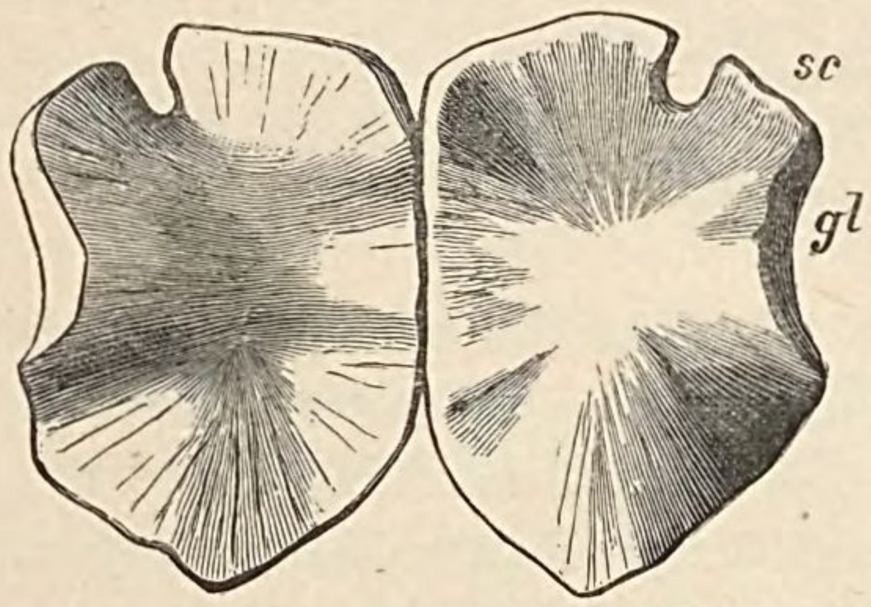
same individual as the preceding; from Curcy. The relative length of the centra is well shown.

Tesson Collection

32690. Slab showing the left lateral aspect of six cervical vertebræ and one detached centrum, probably belonging to this species; from Curcy. The terminal faces of the centra are subcordiform, and the upper costal articulation is partly on the arch. *Same history.*

32669. (*Fig.*) The two coracoids; from Curcy. Probably belong to the same individual as one of the above-mentioned crania.

Fig. 30.



Ichthyosaurus zetlandicus.—Ventral aspect of the coracoids; from the Upper Lias of Normandy. $\frac{1}{3}$. *sc*, scapular articulation; *gl*, glenoid cavity.

The contour of these specimens (fig. 30) agrees with that of the coracoid of *I. acutirostris*, No. 14553, and also has a strong general resemblance to that of the corresponding bone of *I. integer*, figured by Wagner in the 'Abh. k.-bay. Ak. Wiss.' vol. vi. pt. 2, pl. xvi. fig. 1. A comparison of these specimens with the specifically undetermined coracoid noticed on page 72 (No. 28327) exhibits the modification of contour induced by pressure, the two specimens having originally been in all probability very similar.

Same history.

32670. The interclavicle; from Curcy. *Same history.*

32672. A clavicle; from Curcy. *Same history.*

32671. The right scapula; from Curcy. Probably associated with one of the preceding specimens. The proximal extremity shows the strong anterior dorsal ridge as in the corresponding bone of the skeleton No. R. 971 mentioned on p. 74. *Same history.*

32679. The right humerus, wanting the radial angle of the distal extremity; from Curcy. This specimen was probably associated with some of the preceding specimens. Although the proximal extremity has the general contour of the same part in *I. communis*, the shaft is relatively longer and more curved, and the ventral surface is more concave.
Tesson Collection.

32692. An imperfect quadrate; from Curcy. *Same history.*

32694. The centrum of an anterior caudal vertebra, probably belonging to this species; from the Upper Lias of Canieres de Landes (Calvados). This specimen indicates a considerably larger individual than those to which the preceding Normandy specimens belonged; it agrees with other vertebræ of the present form in its comparatively long centrum.

47420. A large left coracoid, probably belonging to this or the preceding species; from the Upper Lias of the Vale of Belvoir, Leicestershire. Allowing for the absence of the posterior extremity, this specimen closely resembles No. 32669. Its transverse diameter is 0,220. *Purchased*, 1876.

b. *Tenuirostrine Subgroup.*

Teeth and mandible of same general structure as in preceding subgroup. Vertebræ apparently similar to those of the typical subgroup of the Latipinnate group. Coracoid with posterior notch. Humerus with the proximal extremity triangular, and the longer axis of the same directed transversely; the structure of this bone thus corresponding with that of the femur. Pectoral limb larger than pelvic. The pubis and ischium are short and wide.

In the structure of the limbs this and the next subgroup appear to be the most generalized forms of the genus; this being especially shown in the similarity of the humerus to the femur. The relatively small size of the pelvic to the pectoral limb indicates, however, that this group is more specialized than *I. platyodon*; since it is most probable that the order was derived from Reptiles in which the pelvic limb was at least as large as the pectoral.

The structure of the coracoid indicates affinity with *I. communis*.

Ichthyosaurus tenuirostris, Conybeare [1].

Syn. *Ichthyosaurus chirostrongulostinus*, Hawkins [2].
Ichthyosaurus grandipes, Sharpe [3].
Ichthyosaurus sinuatus, Theodori [4].

Cranial rostrum very long and slender, and in the adult exceeding four times the diameter of the orbit; supratemporal fossa in the form of an equilateral triangle (compare fig. 33) [5]; fronto-nasal region comparatively broad and flat, narrowing gradually towards rostrum, and lateral borders of frontal aspect of nasals rounded in front of orbits; parietals forming a broad flat bar between supratemporal fossæ. Jaws completely toothed. Pectoral limb (compare fig. 32) comparatively short, with anterior border of radiale either notched or entire, but that of adjacent carpale of second transverse row always entire; and all the bones very large, more or less polygonal, and those of the first longitudinal ulnar row not distinctly oblong. Humerus with slender shaft and much expanded distal extremity. Scapula with proximal border much rounded, and without prominent anterior ridge on dorsal surface. The radius (fig. 25) has the vertical diameter almost as long as the transverse; and usually articulates by a long facet with the ulna, so that the facet for the intermedium becomes much reduced, and the ulnar border is consequently nearly straight. The radius and ulna frequently anchylose with one another, and sometimes also with the adjacent bones; and a small circular vacuity generally remains between the two. The relative length of the rostrum seems to have increased with age. A skeleton in the Museum of Practical Geology, from Street, shows that the contour of the facial profile was not dissimilar to that of the next species.

This species does not appear to have attained very large dimensions; and occurs in both the Upper and Lower Lias.

Hab. Europe (England and Würtemberg).

R. 1120. (*Fig.*) Slab showing the dorsal aspect of a nearly entire skeleton; probably from the Lower Lias of Lyme-Regis, Dorsetshire. Figured by Owen in his 'Liassic Reptilia' (Mon. Pal.

[1] Trans. Geol. Soc. ser. 2, vol. i. pt. i. p. 108 (1822).

[2] Memoirs on Ichthyosauri, &c. pl. xvi. (1834).

[3] Proc. Geol. Soc. vol. i. p. 222 (1830).

[4] Beschreib. des *Ichthyosaurus trigonodon*, p. 50, Munich (1854).—As a variety.

[5] *I. latifrons* is so closely allied to this species that the figures of this part of the skull and of the pectoral limb of the latter may be compared with this description.

Soc.), pt. iii. pl. xxxii. fig. 1. The entire length of this specimen is about 11 feet 4 inches. The skull is crushed and has lost the extremity of the rostrum; but exhibits the contour of the orbits. The entire series of vertebral centra, as well as the ribs, are well shown, but the neural spines are not apparent. The greater portion of the pectoral limbs is shown, but of the pelvic limbs only the right femur remains, although the left limb is introduced in Owen's figure. The teeth seem to be small; and the extremity of the rostrum is wanting. *No history.*

2008 *. (*Fig.*) Slab exhibiting the ventral aspect of the skull and the left lateral aspect of the greater portion of the vertebral column; from the Lower Lias of Street, near Glastonbury, Somersetshire. Figured in Hawkins's 'Sea Dragons,' pl. xii. The skull is very imperfect, but the teeth are shown in the basal portion of the rostrum. The anterior portion of the vertebral column is wanting, but the posterior dorsal and caudal region is well preserved. The pectoral limbs are absent, and the pelvic are somewhat broken up, one of them being thrown across the vertebral column. *Hawkins Collection. Purchased*, 1834.

R. 498. Slab exhibiting the dorsal aspect of the entire skeleton of a medium-sized individual; from the Lower Lias of Street. The only loss that this specimen has sustained consists of a few phalangeals and the terminal caudal vertebræ. The skull is somewhat crushed, but exhibits the equilateral contour of the supratemporal fossæ, and the parietal foramen. There are four rows of phalangeals in the pectoral limb; two series of bones articulating with the ulnare. There is a small notch in the left radiale, but none in the right.
Presented by A. Gillett, Esq., 1884.

38522. Slab exhibiting the left lateral aspect of a nearly entire skeleton of medium size; from the Lower Lias of Lyme-Regis. The skull is much crushed, but shows the teeth very distinctly. The whole of the vertebral column and ribs are preserved. On the left side the scapula and coracoid are shown; while there is also exhibited the dorsal aspect of the proximal portion of the right pectoral limb. There are also fragments of the pelvic limbs.
Purchased, 1863.

R. 1123. Slab showing the right lateral aspect of an imperfect skeleton; from the Lias, locality unknown. The skull, dorso-lumbar region of the vertebral column, and the greater portion of both pectoral limbs are preserved. The skull is very imperfect. The anterior border of the radiale is entire. *No history.*

2011 *. (*Fig.*) Slab showing a considerable portion of the vertebral column, detached vertebral centra, ribs, portions of the limbs, and teeth of this or the next species; from the Lower Lias of Keinton, Somersetshire. The imperfect and anchylosed radius and ulna are preserved in contact with a fragment of the humerus, and afford the grounds of specific determination. One femur is preserved and has facets for the attachment of three bones distally; the tibia is absent, but the other two bones of the same row are in position, the middle one of the original three being almost certainly the intermedium. A tendency to the upthrusting of the latter bone is seen in the pelvic limb of No. R. 498, and in the large skeleton of *I. platyodon*. Figured by Hawkins in his 'Sea Dragons,' pl. xv. *Hawkins Collection.*

R. 1124. A broken slab exhibiting an imperfect mandible, a quadrate, a number of vertebræ and ribs, the coracoids, scapulæ, and the ventral aspect of the proximal portion of the left pectoral limb; probably from Street. The pectoral limb exhibits the humerus, radius, ulna, and intermedium in their natural position; which have all the characters of the present species. The mandible and scapula are more like those of *I. intermedius*, and there may be remains of two species on the slab.

? Same history.

R. 1125. Slab showing the ventral aspect of an imperfect skull, and of the right coracoid, scapula, and greater portion of the pectoral limb; from the Lias, locality unknown. The humerus is wanting, but the characteristic features of the other bones of the paddle are well shown. *No history.*

R. 1121. Slab exhibiting the caudal region of the vertebral column, both limbs of the right side, and the pelvic of the left; probably from Street. The right pectoral limb is shown from the dorsal, and the right pelvic from the ventral

aspect; the left pelvic limb is beneath the vertebral column. This specimen may have belonged to the next species. *No history.*

2009 *. (*Fig.*) Slab showing an oblique frontal and left lateral view of the somewhat crushed skull of an immature individual; from Street. Figured by Hawkins in his 'Sea Dragons,' pl. xiii., and also by Owen in his 'Liassic Reptilia,' pt. iii. pl. xxxii. fig. 2. (In the latter figure the scale is $\frac{1}{3}$ instead of $\frac{1}{5}$ as stated in the description.) The length of the rostrum is about four times the diameter of the orbit. The teeth are present, although displaced from their groove, throughout the length of the jaws: they are drawn relatively too large in Owen's figure. *Hawkins Collection.*

R. 1126. A full-sized skull, wanting the greater portion of the rostrum, and with the fronto-nasal region crushed in, and the orbits in consequence abnormally elongated antero-posteriorly; probably from the Lower Lias of Lyme-Regis. This specimen seems to agree exactly in size with the corresponding portion of the skull of No. R. 1120. Although its crushed condition interferes with accurate comparison, the large and flattened parietals are well shown; the straightness of the facial profile is probably due to crushing. The posterior teeth still remain. *No history.*

40348. Slab showing the crushed skull of an immature individual; from the Lower Lias of Lyme-Regis. *Purchased*, 1867.

24300. Plaster slab showing the ventral aspect of a very similar skull; from the Lower Lias of Glastonbury, Somersetshire. The conjoint atlas and axis are preserved between the mandibular rami. *Purchased*, 1849.

2160 *. Slab showing one lateral aspect of the middle portion of the rostrum; probably from the Lower Lias of Street. The teeth are in beautiful preservation. *Hawkins Collection.*

2012 *. (*Fig.*) Slab showing the anterior portion of the caudal region of the vertebral column, the dorsal aspect of the disjointed right pelvic limb, fragments of the left do., and a few bones apparently belonging to the pectoral limb; from the Lower Lias of Street. Figured by Hawkins in his 'Sea Dragons,' pl. xvi. *Same history.*

40129. Slab showing six crushed caudal vertebræ, the proximal portion of the left pelvic limb, and one bone of the pelvis; from the Lower Lias of Keynsham, near Bristol.
Purchased, 1866.

41253. The proximal portions of the right and left pectoral limbs of one individual; from the Lower Lias of Tewkesbury, Gloucestershire. Both specimens show the humerus, radius, ulna, radiale, and intermedium. The radius and ulna are anchylosed together, and the anterior border of the radiale is entire. *Purchased*, 1869.

R. 1127. The left humerus, with the radius and ulna anchylosed to it; probably from the Lower Lias of Street. *No history.*

R. 1127 a. The left humerus, with the radius, ulna, and intermedium attached to it; locality unknown. The four bones are firmly anchylosed together, and there is a circular vacuity between the radius and ulna. *No history.*

R. 1127 b. The left humerus, with the radius and ulna anchylosed to it; locality unknown. *No history.*

R. 1127 c. A crushed humerus apparently of the same type as the preceding; locality unknown. *No history.*

R. 1127 d. The right humerus of a rather smaller individual than either of the preceding; locality unknown. *No history.*

47436. The left humerus of an individual agreeing in size with the first of the above-mentioned specimens; locality unknown.
Sharp Collection. Purchased, 1876.

R. 1128. (*Fig.*) The left radius; probably from Street. Figured in wood-cut, fig. 25 (p. 69). *No history.*

R. 1128 a. A very similar radius; locality unknown. *No history.*

R. 1128 b. A smaller radius; locality unknown. *No history.*

2146 *. A radius; locality unknown. *Hawkins Collection.*

R. 1129. Slab showing the dorsal aspect of the imperfect left pectoral limb; from the Lower Lias of Lyme-Regis. The femur, radius, ulna, and three bones of the second ulnar longitudinal row are preserved. *No history.*

R. 1129 a. (*Fig.*) The left femur; probably from Street. This specimen, which is represented in woodcut, fig. 26 (p. 70), may have belonged to the same individual as No. R. 1127.
No history.

R. 1129 b. A somewhat smaller left femur; from the Lower Lias, locality unknown. *No history.*

R. 1219. Slab showing an ischium and pubis probably belonging to this species; from the Lower Lias of Street or Lyme-Regis. Accords with the pelvis of the skeleton No. 38522; the two bones are short and broad and anchylosed together at the symphysis. *No history.*

The following specimens are probably referable either to the present or following species.

36876. Slab showing the imperfect rostrum of a large individual; from the Upper Lias of Whitby. *Purchased*, 1862.

R. 225. The imperfect symphysial portion of a mandible, and a slab showing the palatal aspect of the cranial rostrum of the same individual; from the Lower Lias of Lyme-Regis. A large number of the teeth are preserved, and while the anterior ones are very small and slender, those in the posterior part of the jaw are much larger.
Purchased, 1882.

R. 586. The extremity of a very similar rostrum; from Lyme-Regis. The teeth are well preserved. *Purchased*, 1885.

R. 36. Slab showing the ventral aspect of the rostral and frontal region of the crushed skull of a large individual; from Lyme-Regis. The mandible has been crushed on to the cranial rostrum. *Purchased*, 1880.

R. 1165. Slab showing the ventral aspect of a large imperfect rostrum; probably from Lyme-Regis. The mandible is crossed upon the premaxillæ. *No history.*

R. 982. Slab showing the imperfect cranial rostrum and portions of the vertebral column of a small individual; from Lyme-Regis. The subpentagonal cordiform contour of one of the cervical centra is shown. *No history.*

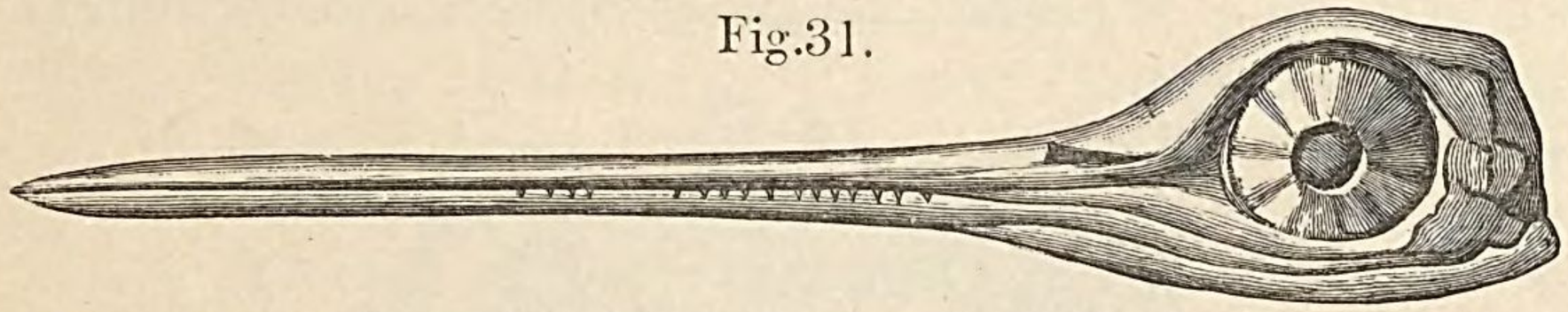
R. 982 a. Slab showing the right lateral aspect of the imperfect rostrum of a comparatively small individual; probably from Lyme-Regis. *No history.*

Ichthyosaurus latifrons, König [1].

Syn. *Ichthyosaurus longirostris*, Owen [2].
Ichthyosaurus laticeps, Owen [3].
(?) *Ichthyosaurus longirostris*, Jäger [4].

The cranial rostrum still more elongated and slender than in *I. tenuirostris*, its length in some cases exceeding six times the diameter

Fig.31.

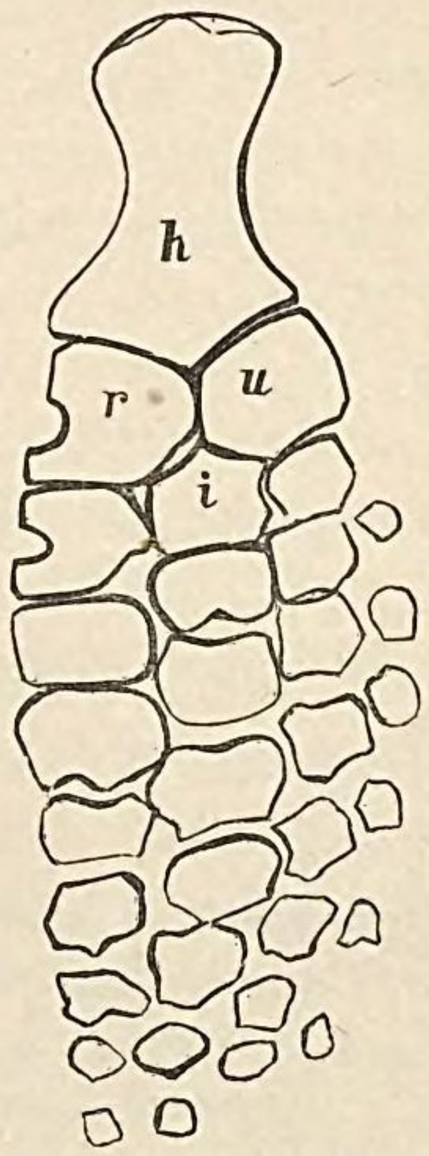


Ichthyosaurus latifrons.—Left lateral aspect of the skull; from the Lower Lias of Barrow-on-Soar. About $\frac{1}{8}$. (*After Owen.*)

of the orbit; orbit relatively very large; fronto-nasal region very wide and somewhat convex, narrowing suddenly towards the rostrum, and facial profile forming a sudden dip in advance of orbit; parietals forming an acute ridge between supratemporal fossæ. Parietal foramen placed entirely in frontals. Teeth minute, and apparently in some instances disappearing from the anterior part of the rostrum in the adult. Paddles (fig. 32) very similar to those of *I. tenuirostris*; but the humerus relatively more slender and less expanded distally. Scapula more like that of *I. platyodon*.

There appear no characters by which *I. longirostris*, Owen, can be distinguished from this species, which occurs in both the Upper and Lower Lias. The type specimens of *I. longirostris*, Jäger, from the Upper Lias of Würtemberg, agree with this species in the extreme length of the rostrum, and are therefore probably specifically the same. The apparent identity of *I. longirostris* with this species is mentioned by Tate and Blake in their 'Yorkshire Lias,' p. 254 (1876).

Fig. 32.



Ichthyosaurus latifrons.—Dorsal aspect of the left [5] pectoral limb; from the Lower Lias of Barrow-on-Soar. *h*, humerus; *r*, radius; *u*, ulna; *i*, intermedium. $\frac{1}{3}$. (*After Owen.*)

Hab. Europe (England and Würtemberg).

[1] Icones Foss. Sectiles, pl. xix. (1825).

[2] Liassic Reptilia (Mon. Pal. Soc.), pt. iii. p. 124 (1881). Also mentioned by Mantell in his 'Petrifactions and their Teachings,' p. 385 (1851).

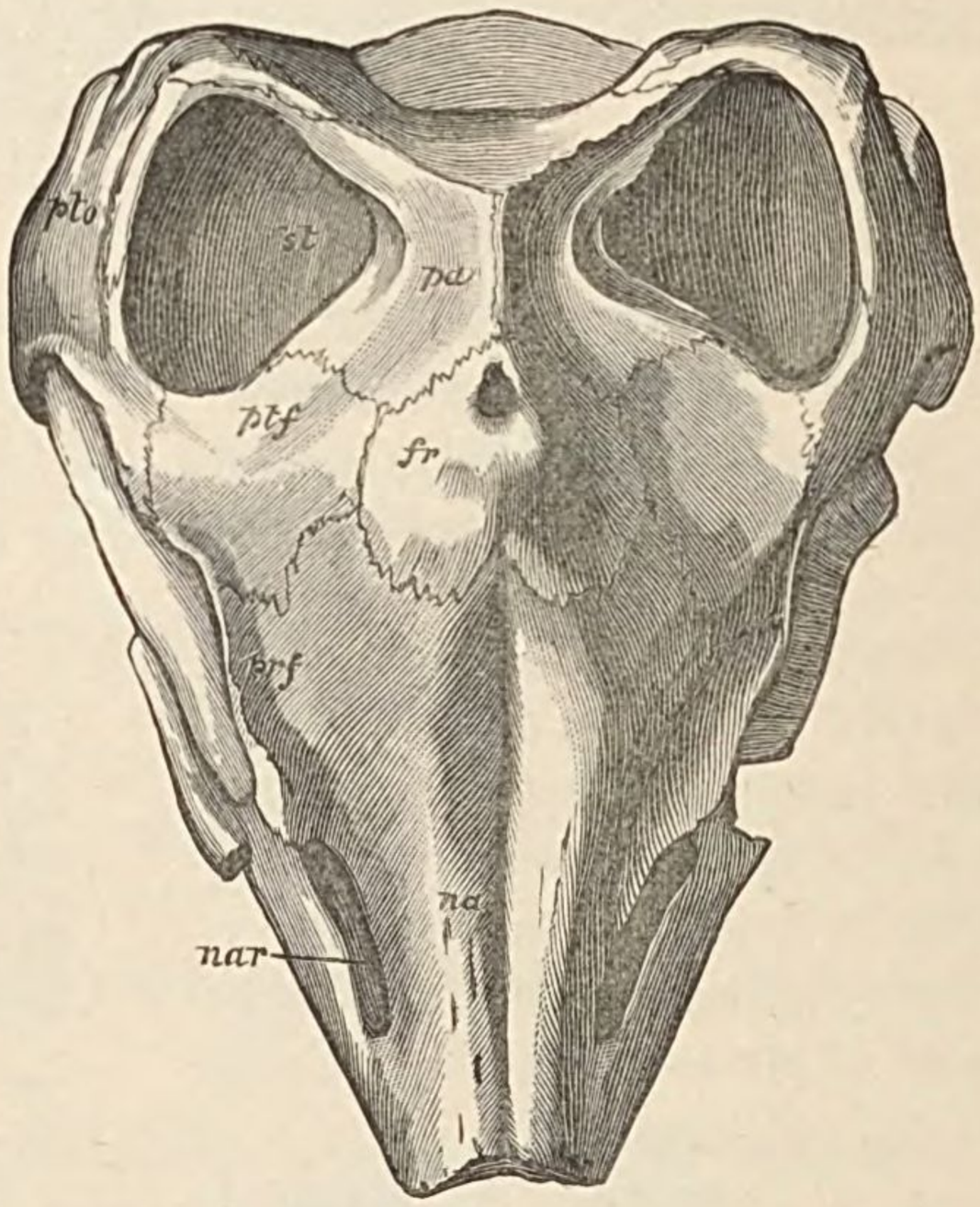
[3] *Op. cit.* p. 120.—*Errorim.*

[4] Nova Acta Ac. Cæs. Leop.-Car. vol. xxv. pt. 2, p. 939 *et seq.* (1856).

[5] This figure is really a reversed view of the right limb, but it is less liable to cause confusion by terming it left.

R. 1122. (*Fig.*) The imperfect cranium, and a mass of matrix containing a large portion of the vertebral column; probably from the Lower Lias of Barrow-on-Soar, Leicestershire. The type specimen. Figured by König in his 'Icones Foss. Sectiles,' pl. xix. fig. 250, and the dorsal aspect of the skull by Owen in his 'Liassic Reptilia' (Mon. Pal. Soc.), pt. iii. pl. xxvii. fig. 1, from which the accompanying woodcut is reduced.

Fig. 33.



Ichthyosaurus latifrons.—Frontal aspect of the imperfect cranium; from the Lower Lias of Barrow-on-Soar. $\frac{1}{3}$. *nar*, nares; *na*, nasals; *prf*, prefrontal *fr*, frontal; *ptf*, postfrontal; *pto*, postorbital; *pa*, parietal; *st*, supra-temporal fossa.

The rostrum of the cranium is broken off immediately in advance of the nares; the orbital region preserves its original contour, and the parietal foramen and supra-temporal fossæ are entire. The alveolar margins of the palate are imperfect. Both the centra and arches of the vertebral column are preserved. *No history.*

38709. (*Fig.*) Slab showing the left lateral aspect of an imperfect skeleton; from the Lower Lias of Barrow-on-Soar, Leicestershire. The greater portion of the cranial rostrum is wanting, and the caudal region is also imperfect. The coracoids and the left side of the pelvis are also shown, but the limbs are

very imperfect. Impressions of the surface of the skin are shown in the matrix. This specimen is described by Owen in his 'Liassic Reptilia,' pt. iii. p. 119, and the conjoint atlas and axis vertebræ are represented in pl. xxiii. fig. 6, and the coracoids in pl. xxxii. fig. 9.

Purchased, 1864.

36182. (*Fig.*) Slab exhibiting the right lateral aspect of a nearly entire skeleton; from the Lower Lias of Barrow-on-Soar. The type of *I. longirostris*, Owen. Figured by Owen in his 'Liassic Reptilia' (Mon. Pal. Soc.), pt. 3, pl. xxxii. fig. 7. The skull is nearly perfect, and has the sclerotic ossifications beautifully preserved. Both scapulæ are well preserved, but the coracoids are not apparent. The limbs of the right side are nearly entire. The extremity of the rostrum is wanting, but the portion remaining is equal to nearly five times the diameter of the orbit. The skull is represented in woodcut, fig. 31. The right limbs are figured by Owen in his 'Liassic Reptilia,' pl. xxxii. fig. 4 (reversed), under the name of *I. tenuirostris*, his figure of the pectoral limb being reproduced in fig. 32. The narrower and less expanded form of the humerus characteristic of the species can be well seen by comparison with that of the skeleton of *I. tenuirostris*, No. R. 498. In the following specimens the humerus is abnormally widened by pressure.

Purchased, 1861.

14566. (*Fig.*) Slab showing the dorsal aspect of an imperfect skeleton; from the Upper Lias of Whitby, Yorkshire. The entire skull remains in a damaged condition, and the greater part of the vertebral column; but of the limbs only the proximal portion of the right pectoral remains. Mentioned by Mantell in his 'Petrifactions,' p. 385. The dorsal aspect of the skull is figured by Owen in his 'Liassic Reptilia,' pt. iii. pl. xxxii. fig. 8, as *I. longirostris*. The length of the rostrum is about $6\frac{1}{2}$ times the diameter of the orbit.

Purchased.

36876. The imperfect skull of a very large individual; from the Upper Lias of Whitby. The left orbit, with the disconnected sclerotic bones, and a large portion of the extremely elongated cranial rostrum, are well preserved.

Purchased, 1862.

R. 1152. The imperfect posterior portion of a crushed cranium; probably from the Lower Lias of Barrow-on-Soar. The

parieto-frontal region is fairly well preserved, and agrees closely with that of No. R. 1122. The almost entire inclusion of the parietal foramen in the frontals is exhibited very clearly. *No history.*

R. 322. A right humerus probably belonging to this form ; from the Lower Lias of Lyme-Regis. Although larger this specimen closely resembles the humerus of No. 36182, and differs from that of *I. tenuirostris.*
Enniskillen Collection. Purchased, 1882.

32395. A right femur probably belonging to this species ; from the Lower Lias of Lyme-Regis. This specimen, although larger, accords in contour with the femur of No. 36182, and differs considerably from that of *I. tenuirostris*, No. R. 1129. *Purchased.*

c. *Platyodont Subgroup.*

Teeth relatively large, and either cylindrical and grooved, or with compressed carinated crowns and the roots invested with cement. Superior border of articular bone of mandible sometimes not raised above the level of the alveolar border of the dentary. Centra of cervical vertebræ (when known) laterally expanded, and those of late posterior dorsals and anterior caudals narrowed superiorly ; upper costal tubercles of a few of the anterior cervicals supported partly on the arch. Coracoid (when known) with small posterior notch. Humerus as in the Acutirostrine subgroup. Pectoral limb in some cases not much larger than the pelvic.

Ichthyosaurus lonchiodon, Owen[1].

Cranial rostrum comparatively short and stout, and about equal to three times the diameter of the orbit ; maxilla excluded from narial aperture by junction of premaxilla with lachrymal ; other cranial characters not apparent. Superior border of articular not raised above the level of the alveolar border of the dentary. Teeth cylindrical, long, and straight, with the flutings of the crown separated by a distinct smooth interval from the coarser ones of the root. Neural spines of dorsal vertebræ excessively low and broad ; and the centra of all the vertebræ comparatively short and with flattened terminal faces. Limbs imperfectly known, but the pectoral considerably larger than the pelvic ; component bones relatively small ; and the anterior border of the radiale, and (judging from the pelvic

[1] Rep. Brit. Assoc. for 1839, p. 116 (1840).

limb) the adjacent carpale of the second transverse row notched. Scapula resembling that of *I. tenuirostris*.

The type specimen indicates an individual of which the length was about twenty-four feet. This species has been recorded only from the Lower Lias, and appears to be of rare occurrence.

Hab. Europe (England).

14564. Slab showing the left lateral aspect of a very large skeleton; (*Fig.*) from the Lower Lias of Lyme-Regis, Dorsetshire. The type specimen. Described by Owen in the 'Rep. Brit. Assoc.' for 1839, pp. 116–117, and figured by Hawkins in his 'Sea Dragons,' pl. ii., and also by Owen in his 'Liassic Reptilia' (Mon. Pal. Soc.), pt. iii. pl. xxxi. figs. 4–7. One tooth is figured by Owen in his 'Odontography,' pl. lxxiii. fig. 2. A notice is also given on p. 384 of Mantell's 'Petrefactions.' The lateral surface of the skull is preserved, but only a small portion of the upper surface is shown; the hyoids are in their natural position. The vertebral column is nearly complete, although some of the centra have slipped upon one another. Of the limbs the pectoral pair are very imperfect, and only fragments of the pelvic ones are preserved. The right pectoral paddle, which has been thrust to the left side, shows the notched radius and radiale, and has only three longitudinal rows remaining, although four may originally have been present. The length of the cranial rostrum is equal to about three times the diameter of the orbit. There are 120 vertebræ remaining, but a few are missing in the caudal region. This specimen is one of those collected by Miss Anning.

Hawkins Collection. Purchased, 1834.

R. 1119. Slab showing the left lateral aspect of the anterior portion of a comparatively small skeleton provisionally referred to this species; probably from the Lower Lias of Lyme-Regis. The skull lacks the extremity of the rostrum, but is otherwise fairly well preserved. The teeth are relatively large, and have long lanceolate crowns like those of the type. The contour of the alveolar border of the mandible is also similar. About 26 vertebræ are shown, and they have the short and wide neural spines characteristic of this species. The left scapula, and the two coracoids and humeri are shown, although somewhat ill-defined. The humerus resembles that of the type. The radius, ulna, and inter-

medium remain in proximity to the left humerus, and these show the general contour characteristic of this group. No notch is, however, shown in the anterior border of the radius; but this may be due either to a disintegration of the periphery of the bone or to its incomplete ossification, —one of which conditions seems certainly to obtain.

No history.

R. 1166. Slab showing the ventral aspect of a large mandible apparently belonging to this species; from Lyme-Regis. The splenial, which has been separated from the dentary, extends to the extremity of the mandible. Several detached teeth are shown, the anterior ones having the long and slender crowns characteristic of this species. The posterior teeth are shorter, as in the type. Impressions of the Lower Liassic *Ammonites turneri* are seen in the matrix.

No history.

28308. Slab showing a fragment of a cranium probably belonging to this species; from Lyme-Regis. A few of the characteristic long-crowned teeth are preserved near the extremity.

Purchased, 1853.

Ichthyosaurus (**?**), sp.

The teeth of the general type of those of *I. lonchiodon*, but with the crowns laterally compressed and indistinctly carinated.

Hab. Europe (England).

R. 1342. Fragment of rock containing an imperfect tooth; from the Rhætic (Upper Triassic) bone-bed of Aust Cliff, near Bristol. Both the root and the crown are fluted, the former the more coarsely.

Harford Collection. Purchased, 1888.

Ichthyosaurus platyodon, Conybeare [1].

Syn. *Ichthyosaurus chiroligostinus*, Hawkins [2].
Ichthyosaurus giganteus, Leach [3].

Cranial rostrum of medium length and stoutness; premaxilla and lachrymal uniting to exclude maxilla from nares; supratemporal fossa long and triangular. Superior border of articular raised above

[1] Trans. Geol. Soc. ser. 2, vol. i. pt. 1, p. 108 (1822).
[2] Memoirs on Ichthyosauri, &c. pl. iii. (1834).
[3] Quoted by Owen in the Rep. Brit. Assoc. for 1839, p. 112 (1840).

alveolar border of dentary. Teeth (fig. 34) with laterally-compressed, carinated and smooth crowns, and their roots invested with cement. Vertebral centra of considerable length, distinctly cupped, and with very prominent costal tubercles. Pelvic limb nearly as large as pectoral; humerus and femur short and thick; radiale and adjacent carpale notched; component bones of paddle of moderate size. Scapula with proximal border long and comparatively straight, with prominent ridge on the anterior border of its dorsal surface.

This species attains larger dimensions than any other Liassic representative of the genus. Assuming that the order is derived from Reptiles in which the pelvic limb was at least as large as the pectoral, this species may be regarded as the most generalized representative of the genus. Generalized characters are, moreover, not improbably indicated by the teeth, which resemble those of the Parasuchian Crocodiles and of many Squamata. This species appears to be confined to the Lower Lias.

Hab. Europe (England).

2003*. (*Fig.*) Slab showing the dorsal aspect of the nearly entire skeleton; from the Lower Lias of Lyme-Regis, Dorsetshire. Although the skull is much smaller than several of the following specimens, the length of this skeleton indicates an individual of about twenty-four feet in length. The extremity of the caudal region, the right pectoral limb, and the neural spines and chevrons of many of the caudal vertebræ are missing, and have been restored in plaster. The upper surface of the cranium is crushed in, but the contour of the supratemporal fossa is still shown; and many of the teeth still retain their characteristic crowns. The pelvic limb shows four longitudinal rows of phalangeals, but in the pectoral there are only three such rows remaining. This specimen was obtained by Miss Anning in 1832; it is described by Owen in the 'Rep. Brit. Assoc.' for 1839, pp. 112–114; and is figured by Hawkins in his 'Sea Dragons,' pl. iii., by Buckland in his 'Geology and Mineralogy' (Bridgewater Treatise), pl. vii., by Kiprijanoff in the 'Mém. Ac. Imp. St. Pétersbourg,' vol. xxviii. art. 8, pl. xviii., and also by Owen in his 'Liassic Reptilia' (Mon. Pal. Soc.), pt. iii. pl. xxxi. figs. 1 and 3. It is noticed by Mantell in his 'Petrifactions', pp. 381–383.

Hawkins Collection. Purchased, 1834.

R. 808. The middle portion of the skull of a considerably larger individual; from Lyme-Regis. The left side, from behind

the orbit to a point some six inches in advance of the nares, is well preserved; as is also the corresponding portion of the left dentary bone. The broken anterior surface has been cut and polished to exhibit a section of the component bones and the teeth. The nares are of comparatively small size. The specimen was collected by Miss Mary Anning. *Purchased*, 1821.

R. 215. The slightly imperfect skull of a very large individual; from Lyme-Regis. The right lateral aspect is in a very fine state of preservation, but the sclerotic plates have been crushed in. The teeth show the characteristic features of the species. *Presented by F. Seymour Haden, Esq.*, 1882.

. 1153. Plaster cast of the imperfect skull of a very large individual. The original was obtained from Lyme-Regis, and is preserved in the Museum of the Geological Society. The postorbital portion is wanting, and the rostrum has been twisted to one side, and broken into several segments. The left orbital region is well preserved.

Presented by the Council of the Geological Society.

R. 1154. Slab exhibiting the ventral aspect of the mandible together with portions of the vertebral column, and other bones of a very large individual; from Lyme-Regis. This specimen was named by Conybeare variety *immanis*.

Purchased.

R. 1158. (*Fig.*) The nearly entire skull, with the anterior part of the vertebral column, ribs, and the left pectoral girdle, of a comparatively large individual; from the Lower Lias between Lyme-Regis and Charmouth. The skull was dug up in the year 1812, and the other portion in the following year at a distance of some feet from the spot where the skull lay. The teeth are considerably damaged, but the first two or three on the right side of the extremity of the rostrum exhibit the characteristic compressed and carinated crowns; and the contour of some of the crowns of the teeth on the posterior part of the left side of the rostrum is also characteristic of the species. The left lateral and the greater part of the frontal aspect of the skull are well preserved, but the right orbital region is wanting, and the contour of the supratemporal fossæ is not shown. The neural arches of the vertebræ are wanting. The entire specimen is figured by Home in the 'Phil. Trans.' for 1814, pls. xvii.–

xx., without either generic or specific name. A smaller view of the skull is given by Buckland in his 'Geology and Mineralogy' (Bridgewater Treatise), pl. x. fig. 1; and another by Owen in his 'Liassic Reptilia' (Mon. Pal. Soc.), pt. iii. pl. xxxi. fig. 2. The entire specimen is described by Owen in the 'Rep. Brit. Assoc.' for 1839, p. 113, where it is referred to the present species. The length of the cranial rostrum is rather more than three times the diameter of the orbit. The left sclerotic ring is very perfectly preserved. *Purchased.*

R. 1055. Skull of a very large individual much flattened by vertical pressure; from Lyme-Regis. The component bones are not clearly shown. The greater part of the skeleton was originally in the Museum, but fell to pieces from the presence of pyrites. *Purchased.*

37705. The posterior portion of the cranium of a medium-sized individual; from Lyme-Regis. The specimen is vertically crushed; and the palatal surface has been cut and polished. *Saul Collection. Purchased*, 1863.

37705 a. The hinder portion of the right ramus of a mandible, probably belonging to the same individual as the preceding; from Lyme-Regis. There is the impression of the shell of a large *Ammonites obtusus.* *Saul Collection.*

R. 1056. An imperfect skull, with the anterior vertebræ attached, of a medium-sized individual; from Lyme-Regis. The palatal aspect is well preserved, and exhibits the mandibular symphysis, the pterygoids, and the hyoids. The teeth are fairly preserved and of the characteristic structure. The inferior aspect of the mandibular symphysis is wide, with the extremities diverging.
Purchased, 1853.

R. 312. The imperfect skull of a medium-sized individual; from Lyme-Regis. The skull has been subjected to considerable crushing and distortion, but many of the teeth are well preserved, and show the characteristic carinæ of the crowns.
Enniskillen Collection. Purchased, 18?2.

2004*. (*Fig.*) The left lateral aspect of the middle portion of a crushed and somewhat broken skull, apparently belonging to an immature individual of this species; from Lyme-Regis. Figured by Hawkins in his 'Sea Dragons,' pl. v.; and noticed by

Owen in his 'Liassic Reptilia' (Mon. Pal. Soc.), pt. iii. p. 111 (reference erroneously given as pl. iii. of Hawkins), who compares it to the specimen figured by him as *I. breviceps* (No. R. 1157). The teeth have mostly lost their crowns, but a detached crown in the matrix below the mandible exhibits the carination and compression characteristic of the present species. The characteristic straightness of the alveolar border of the posterior portion of the mandible is also well shown. The sclerotic ossifications are perfect. The right frontal region has been split away from its normal position, and is thrust up above the line of the profile. *Hawkins Collection.*

R. 218. The skull and part of the vertebral column of a medium-sized individual, in a broken and somewhat crushed condition; from Lyme-Regis. The structure of the teeth well shown. *Purchased*, 1882.

R. 1157. (*Fig.*) Slab exhibiting the right lateral aspect of a large skull, provisionally referred to this species; from Lyme-Regis. Figured by Owen in his 'Liassic Reptilia,' pt. iii. pl. xxix. figs. 1, 35, as *I. breviceps*. The teeth exhibit all the characters of those of the present species, but the cranial rostrum is abnormally short and the number of teeth reduced. It is doubtful if the shortness of the rostrum can be considered a specific character, since other specimens show considerable variation in this respect.
Purchased.

R. 1159. Slab showing the frontal aspect of the skull of a medium-sized individual, together with the anterior portion of the vertebral column; from Lyme-Regis. The skull is crushed flat, but the characteristic contour of the supratemporal fossæ is well preserved. *No history.*

R. 1160. Fragment of the upper and lower jaws of a very large individual; from Lyme-Regis. One side has been cut and polished, in order to show longitudinal sections of the teeth. *No history.*

41220. Fragment of the premaxillæ of a medium-sized individual; from Lyme-Regis. Several teeth are preserved, and exhibit very distinctly the mode of implantation in the alveolar groove. *Purchased*, 1868.

R. 878. A fragment of the upper part of the interorbital region of the cranium of a very large individual; from Lyme-Regis. Both the external and internal aspects of the bone are shown, as well as the complete parietal foramen.
No history.

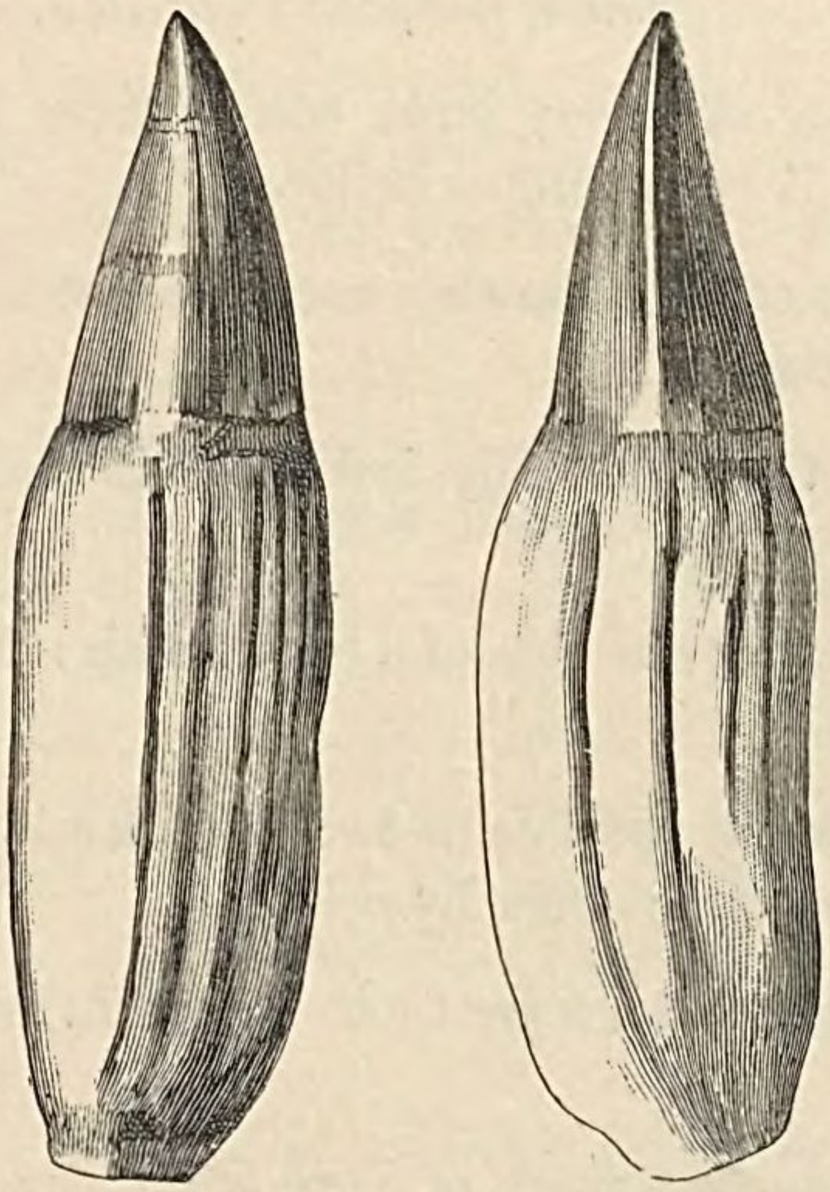
R. 1193. The nearly entire left quadrate of a very large individual; from Lyme-Regis. This specimen agrees approximately in size with the corresponding bone of the skull No. R. 218.
No history.

2149*. The basioccipital of a very large individual; from Lyme-Regis. *Hawkins Collection.*

29016. Slab showing three entire plates of the sclerotic ring; from Lyme-Regis. *Purchased*, 1854.

33283. (*Fig.*) A small tooth; from Lyme-Regis. Figured in the accompanying woodcut. *Purchased*, 1852.

Fig. 34.



Ichthyosaurus platydon.—Lateral and profile views of the tooth No. 33283. $\frac{1}{1}$.

33283 a. Seven similar teeth, not improbably belonging to the same individual; from Lyme-Regis. *Purchased*, 1852.

33283 b. The crown of a considerably larger tooth; from Lyme-Regis. *Purchased*, 1852.

32746. A tooth similar to No. 33283 ; from Lyme-Regis.
Purchased.

32745. Slab containing two similar teeth (together with two Selachian teeth) ; from Lyme-Regis. *Purchased.*

20568. Slab containing a similar tooth ; from the Lower Lias of Bath, Somersetshire. *Johnson Collection. Purchased*, 1845.

20565. Slab showing one side of a very similar tooth ; from Charmouth, Dorsetshire. Noticed by Owen in the 'Rep. Brit. Assoc.' for 1839, p. 113, note.
Johnson Collection. Purchased, 1845.

28310. A very large tooth, with a large portion of the root absorbed ; from Lyme-Regis. *Purchased*, 1853.

28311. Slab showing one aspect of a very similar tooth ; from Lyme-Regis. *Purchased*, 1853.

29015. Two similar teeth ; from Lyme-Regis. *Purchased*, 1854.

41648. A rather smaller tooth ; from Lyme-Regis.
Toulmin-Smith Collection. Purchased, 1869.

33283 c. The root of a very large tooth ; from Lyme-Regis. The fluting is beautifully exhibited. *Purchased*, 1852.

28312. Fragment of rock showing one aspect of a large tooth ; from Lyme-Regis. *Purchased*, 1853.

28309. A large tooth partially imbedded in matrix ; from Lyme-Regis. *Purchased*, 1853.

28284. Slab showing one side of a large tooth ; from Lyme-Regis.
Purchased, 1853.

28283. Slab showing one side of two large teeth, with their crowns in apposition ; from Lyme-Regis. *Purchased*, 1853.

28283 a. The crown of a large tooth ; from Lyme-Regis.
Purchased, 1853.

R. 1013. An imperfect tooth of very large size ; from the Lower Lias, near Warwick.
Presented by M. H. Lakin, Esq., 1887.

R. 1274. A very large tooth, wanting the enamel of the crown ; from Lyme-Regis. The root has been transversely cut, and the surfaces of the section polished.
Harford Collection. Purchased, 1888.

R. 1343. A smaller tooth; from Lyme-Regis. *Harford Collection.*

46. The crown of a very large tooth, with the contour of the basal portion distorted by pressure; from Lyme-Regis.
Presented by Sir Henry de la Beche.

2150*. The conjoint atlas and axis vertebræ with their intercentrum of a very large individual; from Lyme-Regis. These specimens are apparently associated with the basioccipital No. 2149 * (p. 99). *Hawkins Collection.*

481. The centra of seventy associated cervical, dorsal, and caudal vertebræ and portions of ribs, together with the scapulæ and coracoids, of a very large individual; from Lyme-Regis. These specimens, which were collected by Miss Anning, are referred to the present species on account of their large size. The vertebræ are noticed by Owen in the 'Rep. Brit. Assoc.' for 1839, p. 116, where it is stated (from the inclusion of other specimens) that the series numbered 150 centra. The largest centra have a vertical diameter of 0,160 (6·3 inches), and a transverse of 0,170 (6·6 inches). The cervicals are elongated transversely, the upper costal tubercle being placed mainly on the arch. In the early posterior dorsals (marked 26 and 27) the centrum is transversely elongated, the costal tubercles being approximated, and coalescing on the left side of No. 26. In the later posterior dorsals (No. 33) the centrum becomes narrowed superiorly (as in *I. trigonus*, fig. 14), and the costal tubercles are again placed wider apart; they coalesce in No. 36, which may accordingly be reckoned as the first caudal. The coracoids have no posterior notch, and approximate to the type of those of *I. zetlandicus* (fig. 30), although they appear to have been shorter. The ridge on the anterior border of the dorsal border of the proximal extremity of the scapula is distinct.
Purchased. About 1840.

The reference of some of the following specimens is provisional.

R. 1169. The centrum of what is probably the third cervical vertebra; from Lyme-Regis. There is an intercentral facet inferiorly. *No history.*

37707. The centrum of a middle dorsal vertebra of enormous dimensions; from the Lower Lias of Gloucestershire. This specimen, which agrees in characters with the

dorsals of No. 481, is the largest example. The transverse diameter is 0,200 (7·8 inches), and the vertical 0,195 (7·6 inches). *Saul Collection. Purchased*, 1863.

R. 277. The centrum of a middle dorsal vertebra of rather smaller size than the dorsals of No. 481 ; from Lyme-Regis.
Egerton Collection. Purchased, 1882.

R. 316. The centrum of a considerably smaller middle dorsal vertebra probably belonging to this species ; from Lyme-Regis. The general contour is very similar to the centrum marked 25 in No. 481, but the length and the depth of the cupping are relatively greater. These features are, however, probably due to immaturity.
Enniskillen Collection.

42309. Four adjacent centra of middle dorsal vertebræ, cemented together by matrix, agreeing with the preceding specimen ; from Lyme Regis. *Purchased*, 1870.

R. 320. A mass of matrix containing seventeen associated centra of dorsal vertebræ, apparently agreeing with the preceding specimens ; from Lyme-Regis. Remains of *Acrodus* are also shown in the matrix. *Enniskillen Collection.*

R. 226. The centrum of a very large dorsal vertebra ; from Lyme-Regis. This specimen, which is from the later portion of the middle series, is unusually short, but this shortness appears to have been increased by pressure.
Purchased, 1882.

R. 315. A centrum agreeing very closely in size with No. R. 277, but rather later in the series ; from Lyme-Regis.
Enniskillen Collection.

R. 315 a. The centrum of a posterior dorsal vertebra ; from Lyme-Regis. Although somewhat smaller this specimen closely resembles the centrum marked 34 in No. 481.
Enniskillen Collection.

44809. The centrum of a considerably smaller posterior dorsal vertebra ; probably from Lyme-Regis. The depth of the cupping and the length of the centrum are relatively greater than in the larger specimens.
Presented by B. Bright, Esq., 1874.

1151*. The centrum of a very large anterior caudal vertebra; from Lyme-Regis. This specimen agrees with the centrum marked 36 in No. 481, and is said to belong to the same individual. *Purchased.*

R. 315 b. The imperfect centrum of a rather smaller anterior caudal vertebra; from Lyme-Regis. *Enniskillen Collection.*

R. 1170. The centrum of an anterior caudal vertebra; from Lyme-Regis. This specimen differs from the preceding in the absence of distinct narrowing superiorly, and in this respect agrees with the centrum marked 37 in No. 481, which it somewhat exceeds in size. *No history.*

R. 314. The centrum of a somewhat water-worn middle caudal vertebra; probably from Lyme-Regis. This specimen cannot be distinguished from the one marked 59 in No. 481. *Enniskillen Collection.*

R. 1171. The centrum of a later caudal vertebra; from Lyme-Regis. Closely resembles the centrum marked 68 in No. 481. *No history.*

R. 1171 a. The centrum of a very similar caudal vertebra; from Lyme-Regis. The chevron-facets are unusually distinct. *No history.*

18971. An entire rib of a very large individual; from the Lower Lias of Watchet, Somersetshire. This specimen indicates an individual fully double the dimensions of the skeleton, No. 2003*. *Purchased*, 1845

R. 1195. A smaller rib, probably belonging to this species; from the Lower Lias, locality unknown. *No history*

R. 1195 a. Two smaller ribs, perhaps belonging to this form. *No history.*

R. 219. Slab showing the dorsal aspect of the right scapula of a very large individual; from Lyme-Regis. This specimen is considerably larger than the scapula of No. 481. *Purchased*, 1882.

R. 1172. Two slabs showing an imperfect pectoral and pelvic limb and an associated femur of a very large individual; from Lyme-Regis. In the pectoral limb the humerus articulates in the normal way with the radius and ulna; but in the

pelvic limb the intermedium is thrust up to articulate with the femur: and the detached femur of the opposite side shows three distinct distal facets. *No history.*

31940. The imperfect pectoral limb of a smaller individual; from Lyme-Regis. The bones are incorrectly arranged; but it seems that only the radius and the ulna articulated with the humerus. *Purchased. About* 1852.

R. 1161. The left humerus of a very large individual; probably from Lyme-Regis. The length is 0,235, and the transverse diameter of the distal extremity 0,191. The general proportions of this specimen are very similar to those of the humerus of *I. tenuirostris*, but the shaft is less constricted. The transverse elongation of the proximal head is well shown. *No history.*

31939. A somewhat distorted humerus of similar type and of nearly the same dimensions; from Lyme-Regis. *Purchased.*

R. 809. The imperfect proximal portion of the right pectoral limb, associated with the cranium No. R. 808; from Lyme-Regis. There remains the distal extremity of the humerus with the radius, ulna, and intermedium, in their proper relative positions; the arrangements of the other bones is, however, incorrect. *Purchased*, 1821.

R. 1173. A radius agreeing in size with that of the preceding specimen; from Lyme-Regis. The vertical diameter is 0,160 (6·3 inches), and the transverse 0,165 (6·5 inches). *No history.*

40113. The associated radius and ulna of a medium-sized individual probably belonging to this species; from Lyme-Regis. *Purchased.*

R. 1194. An imperfect pelvic limb probably belonging to a medium-sized individual of this species; from Lyme-Regis. The pentagonal intermedium is thrust up to articulate with the femur; the arrangement of the other bones is probably incorrect. *No history.*

32396. A bone which is apparently the right tibia of a comparatively large individual; from Lyme-Regis. *Purchased. About* 1857.

R. 1174 a. A smaller bone of similar type; from Lyme-Regis. *No history.*

R. 1174. One of the bones of the middle of a paddle of a large individual; from Lyme-Regis. *No history.*

Specimens which may perhaps belong to this species.

2031*. (*Fig.*) Fragment of the middle portion of a young cranium not improbably belonging to this species; from Lyme-Regis. Figured by Hawkins in his 'Memoirs on Ichthyosauri &c.' pl. vi. (ed. 1834). The left orbit and nares are shown. *Hawkins Collection.*

2032*. (*Fig.*) Fragment of the rostrum of a somewhat larger skull; from Lyme-Regis. Figured by Hawkins, *op. cit.* pl. vi. The teeth are very imperfectly preserved, but one of them seems to show the coronal structure characteristic of the present species. *Hawkins Collection.*

Ichthyosaurus trigonodon, Theodori [1].

Syn. (?) *Ichthyosaurus crassimanus*, Blake [2].

Apparently closely allied to the preceding, but with the crowns of the teeth only slightly compressed, and their summits when adult bearing three vertical carina, of which two extend to the base of the crown but the third stops short. This species is confined to the Upper Lias, and was originally recorded from Banz, in Bavaria. There is at present no reason for separating *I. crassimanus*, of the Whitby Lias; the entire anterior border of the radius of the type specimen being probably abnormal.

Hab. Europe (Bavaria, Würtemberg [3], England, and ? France).

47153. The posterior portion of the cranial rostrum and a part of a mandibular ramus of a medium-sized individual; from the Upper Lias of Kingsthorpe, Yorkshire. The broken roots of numerous teeth are shown, together with the crowns of some immature examples. These teeth are of the general type of those of *I. platyodon*, having smooth crowns, and deeply fluted roots originally covered with cement, which has now disappeared. The crowns have a sub-circular section, but do not show the carinæ on the summit; in which respect they agree with the immature teeth of the Banz specimen noticed on page 2 of Theodori's

[1] Gelehrte Anzeigen, vol. xvi. p. 906 (1843).
[2] Tate and Blake, 'The Yorkshire Lias,' p. 253 (1876).
[3] See Quenstedt, 'Die Jura,' p. 220 (1858).

'Beschreibung des *Ichthyosaurus trigonodon*' (Munich, 1854). *Sharp Collection. Purchased*, 1876.

32700. The centrum of a middle dorsal vertebra probably belonging to this species; from the Upper Lias of Curcy, near Caen (Calvados), France. This specimen agrees very closely with the corresponding vertebra of *I. platyodon*; its transverse diameter being 0,110, the vertical 0,103, and the length 0,041. It is too large to have belonged to an individual of the size of that to which the large Whitby skull (No. R. 1167) of *I. zetlandicus* pertained; and is relatively shorter than the vertebræ of that species.
Tesson Collection. Purchased, 1857.

32700 a. The centrum of an apparently associated anterior caudal vertebra; from Curcy. Transverse diameter 0,123, vertical diameter 128, length 0,050. This specimen also closely resembles the caudals of *I. platyodon*, and is very different from the caudal from Normandy (No. 32694) provisionally referred to *I. zetlandicus*. *Tesson Collection.*

32700 b. The centrum of a later caudal vertebra of the same individual. *Tesson Collection.*

Specifically undetermined specimens of which at least a considerable number belong to the Longipinnate group.

R. 319. The left scapula of an individual agreeing in size with the type of *I. lonchiodon*; from the Lower Lias of Lyme-Regis. This bone differs very markedly from the scapula of the *I. communis* group, having the anterior part of the coracoidal articulation curved upward so as to form a nearly symmetrical line with the dorsal border of the glenoidal cavity. It may belong to *I. lonchiodon*.
Enniskillen Collection. Purchased, 1882.

32396. A smaller left scapula of similar general contour; from Lyme-Regis. Closely resembles the corresponding bone of the skeleton of *I. tenuirostris*, No. 38522, to which species it may belong. *Purchased*, 1857.

46563. A larger scapula of similar general type, but with the anterior border emarginate; from Lyme-Regis.
Purchased, 1875.

R. 1175. Slab showing the dorsal aspect of a left scapula of the type of No. 32396, but smaller; from Lyme-Regis. *No history.*

R. 267. A crushed left scapula of similar type; from Lyme-Regis.
Egerton Collection. Purchased, 1882.

R. 267 a. A crushed scapula of the same size but of the type of No. 46563. *Egerton Collection.*

R. 267 b. A comparatively small right scapula of the type of that of *I. platyodon*; from Lyme-Regis. The anterior ridge on the dorsal aspect found in the scapula of *I. platydon*, No. 481 (p. 101), is not shown, but this may be due to immaturity. *Egerton Collection.*

R. 67. An imperfect right scapula of comparatively small size; from the Upper Lias of Boll, Würtemberg. This specimen is remarkable for the great expansion of the proximal extremity; it has a well-marked anterior ridge on the dorsal surface proximally, and distally the anterior border is emarginate. It cannot be referred to *I. latifrons* or to *I. zetlandicus*.
Transferred from the Museum of Practical Geology, 1881.

R. 665. Slab showing the dorsal aspect of a very small left scapula, probably belonging to this group; from Lyme-Regis.
Presented by J. E. Lee, Esq., 1885.

2036*. Slab showing the ventral aspect of the coracoids, and both ventral and dorsal aspects of the anterior part of the vertebral column; from the Lower Lias. The coracoid, although somewhat larger, agrees in general contour with the corresponding bone of *I. tenuirostris*, No. 38522 (p. 84), showing a similar small posterior notch.
No history.

32396. A very similar right coracoid; from Lyme-Regis.
Purchased. About 1857.

R. 269. A crushed right coracoid of apparently similar type; from Lyme-Regis. *Egerton Collection.*

R. 1189. Slab showing the ventral aspect of the crushed coracoids of a smaller form; from the Lower Lias. These specimens precisely resemble the coracoid of the above-mentioned skeleton of *I. tenuirostris*. *No history.*

R. 1190. A right coracoid apparently agreeing very closely with that of the preceding specimen; from the Lower Lias.
No history.

R. 1191. A very similar left coracoid; from Lower Lias. *No history.*

28306. Slab showing the ventral aspect of a small left coracoid and the associated interclavicle; from Lyme-Regis. The contour of the coracoid closely resembles No. R. 1189. *Purchased*, 1853.

47437. A smaller left coracoid; horizon and locality unknown. Small *Cidaris*-spines preserved in the matrix are like Jurassic forms. *Sharp Collection. Purchased*, 1876.

40112. An associated right and left coracoid of similar general type to those of No. 2036*, but of considerably larger size; from Lyme-Regis. These specimens may perhaps be referable either to *I. platyodon* or *I. lonchiodon*. *Purchased. About* 1866.

16080. Fragment of sandstone exhibiting one lateral and the distal aspect of a medium-sized humerus; from the Middle Lias of Bugbrook, Northamptonshire. *Purchased. About* 1840.

28119. Slab exhibiting one aspect of a flattened humerus remarkable for its great distal expansion; probably from Lyme-Regis. *Dixon Collection. Purchased*, 1851.

40123. A rather smaller flattened humerus of similar type; from Lyme-Regis. *Purchased. About* 1866.

28999. A large and somewhat flattened humerus, imperfect distally; probably from Lyme-Regis. *Dixon Collection.*

28507. A flattened humerus or femur, with slight distal expansion; from Lyme-Regis. Probably belongs to a small individual of *I. platyodon*. *Dixon Collection.*

28285. An imperfect bone which is apparently an ilium of a large form, probably *I. platyodon*; from Lyme-Regis. *Purchased*, 1853.

32395. An apparently similar bone; from Lyme-Regis. *Purchased.*

40123 a. A smaller bone of similar type; from Lyme-Regis. *Purchased. About* 1866.

Specimens from the Lias of which the Serial Position is uncertain. (*Unless it is stated to the contrary the specimens are Lower Liassic.*)

R. 1198. A polished slab showing on either side a vertical and longitudinal section of the anterior part of the skeleton of a comparatively small Ichthyosaur; locality unknown. Mentioned by Egerton in the 'Trans. Geol. Soc.' ser. 2, vol. v. p. 188, note. *Purchased at the sale of Bullock's Museum.*

R. 1199. Slab exhibiting the cerebral aspect of the hinder portion of the cranium and a part of one mandibular ramus of a considerably larger specimen; probably from Lyme-Regis. The contour of the foramen magnum, of the supratemporal fossæ, and of the orbits is preserved. The basioccipital has the stapes still articulating with it on the right, and the right quadrate remains in a displaced position. *No history.*

2040. (*Fig.*) Slab showing the posterior portion of the cranium of a comparatively small individual, with the component bones displaced; from Lyme-Regis. This specimen exhibits the basioccipital, basisphenoid, presphenoid, quadrate, exoccipitals, supraoccipitals, parietals, and columellas. It is described and the columella of the right side figured by A. Smith Woodward in the Proc. Zool. Soc. 1886, pp. 405–406, fig. 1. *Hawkins Collection. Purchased*, 1834.

44027. Two transverse sections from the anterior portion of the rostrum of a comparatively large skull; from Lyme-Regis. Not improbably belonging to *I. communis*.
Purchased, 1873.

28287. The basioccipital of a very large individual; from Lyme-Regis. Probably belongs to *I. platyodon*. *Purchased*, 1853.

47430. A smaller basioccipital; from Lyme-Regis. This specimen is specifically distinct from the preceding.
Sharp Collection. Purchased, 1876.

41320. A much smaller basioccipital; from Lyme-Regis.
Purchased, 1869.

R. 260. A very similar specimen; from Lyme-Regis.
Egerton Collection. Purchased, 1882.

2081*. A basioccipital agreeing in size with No. 41320, but belonging to a distinct species; from Lyme-Regis.
Hawkins Collection.

2123*. A very similar specimen; from Lyme-Regis.
Hawkins Collection.

R. 1203. A basioccipital specifically distinct from the preceding; from Lyme-Regis. *No history.*

R. 1203 a. A crushed basioccipital with the exoccipital in apposition; from Lyme-Regis. *No history.*

43166. The basisphenoid of a large individual; from Lyme-Regis. The Eustachian canal is well shown.
Wetherell Collection. Purchased, 1871.

2062*. The basioccipital and basisphenoid of a smaller individual; from Lyme-Regis. A vertebral centrum is attached to this specimen. *Hawkins Collection.*

R. 1204. A smaller basioccipital and basisphenoid; from Lyme-Regis. *Presented by Sir P. de Malpas Grey Egerton, Bart.*

R. 1204 a. A small basioccipital, with three associated cervical vertebræ. Figured by Egerton in the 'Trans Geol. Soc.' ser. 2, vol. v. pl. xiv. fig. 7. *Same history.*

R. 1508. A basisphenoid agreeing in size with the corresponding bone of the preceding specimen; from Lyme-Regis.
No history.

R. 266. A smaller basisphenoid; from Lyme-Regis.
Egerton Collection.

28328. The imperfect right quadrate of a very large form; from Lyme-Regis. *Purchased*, 1853.

28507. Slab showing the crushed right quadrate of a smaller form; from Lyme-Regis. *Dixon Collection. Purchased*, 1851.

32396. The crushed left quadrate of a comparatively large individual; from Lyme-Regis. *Purchased. About* 1857.

2147*. Two specimens of the articular bone of the mandible of a relatively large form; from Lyme-Regis.
Hawkins Collection.

42296. Slab showing the ventral aspect of the imperfect mandible of a comparatively small form; from Lyme-Regis. The teeth are small and slender. *Purchased*, 1870.

40110. (*Fig.*) The anchylosed centra of the atlas and axis vertebræ of a comparatively large form; from Lyme-Regis. Figured by Egerton in the 'Trans. Geol. Soc.' ser. 2, vol. v. pl. xiv. figs. 1–2. The intercentrum is wanting. *Purchased.*

R. 1205. (*Fig.*) A considerably smaller specimen of the same compound element; from Lyme-Regis. Figured by Egerton, *op. cit.* pl. xiv. fig. 12. The intercentrum is present and the specimen closely accords with the preceding in contour.
Presented by Sir P. de Malpas Grey Egerton, Bart.

R. 1205 a. (*Fig.*) The centra of a considerably smaller atlas and axis vertebræ; from Lyme-Regis. Figured by Egerton, *op. cit.* pl. xiv. fig. 3. The two centra are separate, but the intercentrum is anchylosed to the axis.

Presented by Sir P. Egerton, Bart.

R. 1509. The anchylosed centra of the atlas, axis, and third cervical vertebræ of a slightly larger form; from Lyme-Regis. The intercentral facets between the atlas and axis are distinctly shown. *No history.*

R. 265. The anchylosed centra of the atlas and axis vertebræ of a very small individual; from Lyme-Regis.

Egerton Collection.

R. 1205 b. (*Fig.*) The cranial intercentrum of a very large individual; from Lyme-Regis. Figured by Egerton, *op. cit.* pl. xiv. figs. 4–6. *Presented by Sir P. Egerton, Bart.*

R. 262. The centrum of an anterior cervical vertebra of a medium-sized form; from Lyme-Regis. The terminal faces are pentagonal and subcordiform, with the upper costal articulation partly confluent with the neurapophysial facet.

Egerton Collection.

16052. The centrum of a larger cervical vertebra; from the Upper Lias of Blisworth, Northamptonshire. Found in 1837 by Miss Baker. *Purchased.*

2074*. The centrum of a small cervical vertebra; from Lyme-Regis.

Hawkins Collection.

R. 68–69. The centra of the anchylosed atlas and axis, and of several cervical vertebræ, together with several of the neural arches and spines; from the Upper Lias of Boll, Würtemberg. The suture between the atlas and axis is obliterated. These specimens not improbably belong to *I. acutirostris.*

Transferred from the Museum of Practical Geology, 1881.

23011. The centrum of a dorsal vertebra of a comparatively large species; from Lyme-Regis. *Purchased*, 1848.

33182. The centrum of a posterior dorsal vertebra agreeing in size with the preceding; from Lyme-Regis.

Purchased. About 1844.

2070*. The imperfect centra of two caudal vertebræ cemented together by matrix; from Lyme-Regis or Street.

Hawkins Collection.

40111. The centrum of a smaller caudal vertebra; from Lyme-Regis. *Purchased.*

R. 308. One half of the centra of two posterior caudal vertebræ of a large form, which have been vertically and longitudinally bisected; from the Upper (?) Lias of Altdorf, Franconia. *By exchange.*

R. 1207. Polished slab showing a section of two large vertebral centra; from Lyme-Regis. *No history.*

R. 1208. Polished slab exhibiting a section of five smaller vertebral centra; from Lyme-Regis. *No history.*

R. 1209. Polished slab showing a section of seven still smaller vertebral centra; from Lyme-Regis. *No history.*

28509. Eleven associated centra of the caudal vertebræ of a large form; from Lyme-Regis. These specimens are probably referable to *I. platyodon.*

Dixon Collection. Purchased, 1851.

41647. A segment from the middle of a large caudal vertebra; from Lyme-Regis.

Toulmin-Smith Collection. Purchased, 1869.

1229. An anterior caudal vertebra of a comparatively small form, wanting the extremity of the neural spine; from the Upper Lias of Whitby, Yorkshire. *Purchased.*

R. 1200. Slab exhibiting the left lateral aspect of the hinder part of the caudal region; probably from Barrow-on-Soar, Leicestershire. *No history.*

R. 1201. Slab showing the ventral aspect of the hinder part of the caudal region of a rather smaller form; from Street, Gloucestershire. *No history.*

R. 1202. Slab showing the left lateral aspect of the extremity of the caudal region and one pelvic bone of a smaller form; probably from Street. *No history.*

R. 1206. Slab exhibiting the dorsal aspect of the interclavicle of a medium-sized form; from Lyme-Regis. *No history.*

28962. The interclavicle of a small individual; from Lyme-Regis.

Dixon Collection. Purchased, 1851.

R. 1210. The transverse portion of the interclavicle of a very large form; from Lyme-Regis. *No history.*

List of Species not mentioned above.

The forms indicated by the under-mentioned names cannot be classified, and it is probable that several of the European ones are synonyms of those already mentioned.

Ichthyosaurus æqualis, Phillips [1]. Kimeridge Clay, England.
,, *angustidens*, Seeley [2]. Up. Chalk, England.
,, *atavus*, Quenstedt [3]. Mid. Trias, Germany.
,, *australis*, M'Coy [4]. Cretaceous, Queensland.
,, *australis*, Hector; see *hectori*.
,, *carinatus*, Sauvage [5]. Up. Trias, France.
? = *Mixosaurus*.
,, *ceramensis*, Martin [6]. (?) Cretaceous, Ceram.
,, *chalorodirus*, Seeley [7]. Kimeridge Clay, England.
,, *coniformis*, Harlan [8]. Low. Lias, England.
,, *crassicostatus*, Theodori [9]. Up. Lias, Bavaria.
,, *gaudensis*, Hulke [10]. Reputed Miocene, Malta.
,, *hectori*, Lydekker. (?) Trias, New Zealand.
Syn. *I. australis*, Hector [11] (? = *Mixosaurus*).
,, *hexagonus*, Theodori [12]. Up. Lias, Bavaria.
,, *hygrodirus*, Seeley [13]. Kimeridge Clay, England.
,, *ingens*, Theodori [14]. Up. Lias, Bavaria.
,, *macrophthalmus* [15], Theodori. Up. Lias, Bavaria.
,, *marathonensis*, Etheridge [16]. Mesozoic, Australia.
,, *megalodirus*, Seeley [17]. Oxford Clay, England.
,, *nordenskioeldi*, Hulke [18]. Trias (?), Spitzbergen.

[1] Geology of Oxford, p. 339 (1871).
[2] Index to Aves &c. in Cambridge Museum, p. xv (1869).
[3] Handbuch der Petrefactenkunde, p. 129 (1852).
[4] Ann. Mag. Nat. Hist. ser. 3, vol. xix. p. 355 (1867). See also Quart. Journ. Geol. Soc. vol. xxviii. p. 278.
[5] Ann. Sci. Géol. vol. vii. art. 6 (1876). See also vol. xiv. art. 3, pp. 14, 17, pls. vii.–ix. (1883).
[6] Samml. Geol. Mus. Leid. ser. 1, vol. iv. p. 74 (1888). [7] *Op. cit.* p. xx.
[8] Journ. Ac. Nat. Sci. Philad. ser. 1, vol. iii. pt. ii. p. 339 (1824).
[9] Beschreibung d. *Ichthyosaurus trigonodon*, p. 60 (Munich, 1854).
[10] Quart. Journ. Geol. Soc. vol. xxvii. p. 29 (1871).
[11] Trans. N. Zealand Inst. vol. vi. p. 355 (1874).—Preoccupied by M'Coy.
[12] *Op. cit.* p. 55. [13] *Op. cit.* p. xx. [14] *Op. cit.* p. 69.
[15] *Ibid.* p. 64.
[16] Proc. Linn. Soc. New South Wales, ser. 2, vol. iii. p. 408 (1888).
[17] *Op. cit.* p. xxi.
[18] Bihang K. Svensk. Vet.-Akad. Handl. vol. i. no. 9, p. 4 (1873).

Ichthyosaurus planartus, Theodori [1]. Up. Lias, Bavaria.
„ *polaris*, Hulke [2]. Trias (?), Spitzbergen.
„ *rheticus*, Sauvage [3]. Up. Trias, France.
(?) = *Mixosaurus*.
„ *triscissus*, Quenstedt [4]. Up. Lias, Würtemberg.

The name *I. latimanus*, as noticed above, must be discarded. The names *I. bonneyi*, *I. doughtyi*, and *I. platymerus*, Seeley, and *I. advenus*, Phillips, are merely MS. ones; the first three being applied to specimens from the Cambridge Greensand, and the fourth to vertebræ from the Stonesfield Slate. *I. walkeri*, Seeley, has been made the type of *Cetarthrosaurus* (*vide suprà*, Pt. I. p. 270).

Genus **MIXOSAURUS,** Baur [5].

Humerus and femur articulating distally with two bones; radius and ulna much longer than broad, and separated from one another by an interval throughout their length.

This genus, which is at present unrepresented in the Museum, is founded upon *Ichthyosaurus cornalianus*, Basani [6], from the Trias of Italy; but it may prove that the other Triassic forms are likewise referable to it. In the type species the teeth are small and less numerous than is usually the case in *Ichthyosaurus*. The founder of the genus refers it to a distinct family.

COPROLITES OF ICHTHYOPTERYGIANS AND SAUROPTERYGIANS.

a. *From the Lower Lias.*

(Unless stated to the contrary, from Lyme-Regis, Dorsetshire.)

28716. A large and somewhat imperfect specimen. *Purchased*, 1853.

33284. A large specimen with one side weathered. Traces of fish-scales are visible. *Purchased*, 1858.

R. 1275. Part of a very large specimen. *Harford Collection.* *Purchased*, 1888.

24769. A large weathered specimen, with one side ground down. Numerous fragments of fish-scales are shown. *Purchased*, 1849.

24769 a. Part of a large specimen. *Purchased*, 1849.

24769 b. Fragment of a large specimen. *Purchased*, 1849.

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[1] Beschreib. d. *Ichthyosaurus trigonodon*, p. 57 (1854).
[2] Bihang K. Sevensk. Vet.-Akad. Handl. vol. i. no. 9, p. 3 (1873).
[3] Ann. Sci. Géol. vol. vii. art. 6 (1876).
[4] Die Jura, p. 218 (1858).
[5] Amer. Nat. vol. xxi. p. 840 (1887). See also Bericht xxth Versamml. Oberrhein. geol. Ver. p. 20 (1887).
[6] Atti Soc. Ital. Sci. Nat. vol. xxix. p. 20 (1886).

24769 c. An imperfect large specimen showing numerous small fish-scales.
Purchased, 1849.

24769 d. A small specimen, in a somewhat flattened condition. *Same history.*

43063. A small and somewhat imperfect specimen. *Purchased*, 1871.

41285. A large weathered specimen, with a portion of one side wanting. Numerous fish-scales are shown. *Purchased*, 1869.

R. 1402. A large weathered specimen, containing numerous fish-scales, &c.
No history.

41285 a. A large specimen, wanting the greater part of the outer layer.
Purchased, 1869.

41285 b. A large specimen, somewhat flattened, and with one side weathered.
Purchased, 1869.

41285 c. A large specimen, with one side wanting; from Lyme-Regis.
Purchased, 1869.

41285 d. An imperfect and flattened large specimen, showing numerous portions of fish-scales. *Purchased*, 1869.

41285 e. A decomposed specimen containing numerous fish-scales.
Purchased, 1869.

41285 f. Part of a large specimen, with one side much decomposed.
Purchased, 1869.

41285 g. An imperfect and somewhat disintegrated specimen. Fish-scales are numerous. *Purchased*, 1869.

41285 h. Part of a large specimen, showing fish-scales and bones.
Purchased, 1869.

33284 a. A large specimen, with one end imbedded in matrix and partly decomposed. *Purchased*, 1858.

R. 280. A very large imperfect specimen.
Egerton Collection. Purchased, 1882.

R. 280 a. Part of a large specimen. This specimen contains five vertebræ (four in natural apposition) and other bones of a small *Ichthyosaurus.*
Egerton Collection.

2066*. (*Fig.*) A partly decomposed specimen in matrix. Figured by Hawkins in his 'Great Sea Dragons,' pl. xxix.; collected by Miss Anning in 1832.
Hawkins Collection. Purchased, 1834.

2066* a. (*Fig.*) A partly decomposed specimen in matrix. Figured by Hawkins, pl. xxx. This specimen contains fish-scales and two vertebræ of a small *Ichthyosaurus.* *Hawkins Collection.*

2102*. (*Fig.*) A large imperfect specimen. Figured by Hawkins, pl. xxix.
Hawkins Collection.

2103*. (*Fig.*) An imperfect specimen contained in a water-worn pebble, of which one side has been cut and polished. Figured by Hawkins, pl. xxix.
Hawkins Collection.

2105*. (*Fig.*) Fragment of rock containing what may be coprolitic matter. Figured by Hawkins, pl. xxx. *Hawkins Collection.*

2107*. A small specimen, with one side decomposed. Figured by Hawkins (*Fig.*) pl. xxx. *Hawkins Collection.*

2108*. A decomposed and flattened small specimen. Figured by Hawkins, (*Fig.*) pl. xxx. *Hawkins Collection.*

2109*. Fragment of rock containing what may be part of a small coprolite. (*Fig.*) Figured by Hawkins, pl. xxx. *Hawkins Collection.*

2110*. A somewhat similar specimen. Figured by Hawkins, pl. xxx. (*Fig.*) *Hawkins Collection.*

2111*. A somewhat similar specimen. Figured by Hawkins, pl. xxx. (*Fig.*) *Hawkins Collection.*

2112*. A specimen of the same type. Figured by Hawkins, pl. xxx. (*Fig.*) *Hawkins Collection.*

2113*. A small specimen of similar type. Figured by Hawkins, pl. xxx. (*Fig.*) *Hawkins Collection.*

2114*. A similar specimen. Figured by Hawkins, pl. xxx. (*Fig.*) *Hawkins Collection.*

2115*. A small and partly decomposed specimen ; from Street, near Glastonbury, (*Fig.*) Somersetshire. Figured by Hawkins, pl. xxix. *Hawkins Collection.*

2116*. A somewhat similar specimen. Figured by Hawkins, pl. xxix. (*Fig.*) *Hawkins Collection.*

2117*. Part of a large and partially decomposed specimen. Figured by Hawkins, pl. xxix. A number of small fish-scales are shown. (*Fig.*) *Hawkins Collection.*

2118*. Fragment of rock containing a small and weathered specimen. (*Fig.*) Figured by Hawkins, pl. xxix. *Hawkins Collection.*

2119*. A crushed and weathered specimen of medium size, showing a number of (*Fig.*) small fish-scales. Figured by Hawkins, pl. xxix. *Hawkins Collection.*

2120*. One half of a large specimen, with the outer surface worn smooth, and the inner one polished. *Hawkins Collection.*

9652. Cast of a large imperfect specimen. The original, which contains numerous fish-scales, is figured by Buckland in the 'Trans. Geol. Soc.' ser. 2, vol. iii. pl. xxix. fig. 1. This and the other specimens figured on the same and the preceding plate were the first of which the true nature was recognized. *Mantell Collection. Purchased*, 1838.

9966. Cast of a smaller specimen. Original figured by Buckland, *op. cit.* pl. xxviii. fig. 2. *Mantell Collection.*

9966 a. Cast of a rather larger specimen. Original figured by Buckland, *op. cit.* pl. xxviii. fig. 7. *Mantell Collection.*

9657. Cast of a large specimen, with one surface decomposed. Original figured by Buckland, *op. cit.* pl. xxviii. fig. 9. *Mantell Collection.*

9660. Cast of a large imperfect specimen. Original figured by Buckland, *op. cit.* pl. xxviii. fig. 4. *Mantell Collection.*

33284 b. Part of a very large specimen, with one side decomposed. Small fish-scales are abundant, and the impressions of the vessels on the surface of the intestine are well shown. *Purchased*, 1858.

33284 c. Fragment of a very similar specimen. *Mantell Collection.*

R. 396. Part of a very large specimen containing jaws of *Eugnathus*.
Enniskillen Collection. Purchased, 1882.

41285 i. Portion of a large imperfect specimen, with one side ground down. Numerous fish-remains are scattered through this specimen.
Purchased, 1869.

41285 j. A medium-sized specimen, with one side cut away and the surface polished. *Purchased*, 1869.

41285 k. A medium-sized specimen, with one side cut away and the surface polished. *Purchased*, 1869.

41285 l. A large water-worn specimen, with one side cut and polished.
Purchased, 1869.

41285 m. A comparatively large and water-worn specimen, with a slice cut away from one side and the surface polished. *Purchased*, 1869.

41285 n. A smaller water-worn specimen, with one side cut and polished.
Purchased, 1869.

41285 o. A small water-worn specimen, with one side cut and polished.
Purchased, 1869.

11247. An imperfect specimen, with one side cut and polished.
Mantell Collection. Purchased, 1838.

44813. One longitudinal half of a worn and comparatively large specimen, with the inner surface polished; from Charmouth, Dorsetshire.
Presented by B. Bright, Esq., 1873.

44813 a. Part of one longitudinal half of a specimen, with the inner surface polished; from Charmouth. *Same history.*

41645. One longitudinal half of a large flattened specimen, with the inner surface polished. *Toulmin-Smith Collection. Purchased*, 1869.

41645 a. An imperfect longitudinal half of a medium-sized specimen, with the inner surface polished. *Toulmin-Smith Collection.*

20564. A longitudinal slice from the middle of a large specimen, with one side polished; from Charmouth. *Purchased*, 1845.

20564 a. A somewhat similar specimen; from Charmouth. *Purchased*, 1849.

R. 1403. Part of a large worn specimen, with one side cut and polished.
No history.

R.1404. Longitudinal section of a very large and partially decomposed specimen. *No history.*

R. 280 b. Transverse section of a specimen. *Egerton Collection.*

b. *From the Upper Lias.*

33185. Slab of rock showing a partially decomposed and flattened specimen; from Boll, Würtemberg. *Purchased.*

SYNAPTOSAURIAN BRANCH.

In the two orders—Sauropterygia and Chelonia—of this branch the following common features may be noted:—

Quadrate firmly attached to cranium; palate more or less completely closed, the pterygoids usually extending forwards to unite with the vomers, when the latter are present; one or two temporal arcades; and a parietal foramen at least in the young. No sclerotic plates. Dorsal ribs as a rule with single heads [1], and articulating either at the junction of two centra, or with a facet or transverse process placed entirely on the arch; cervical ribs, when present, articulating with double or single facets placed on the centrum. No uncinate processes to ribs. Sacral ribs connected with the vertebræ by upper and lower articulations. Either abdominal ribs or a plastron on ventral aspect of body. Chevrons, when present, attached mainly or entirely to the posterior border of the centra; not more than two sacrals.

In the pectoral girdle the precoracoid [2], when present, anchylosing to the scapula; and in the pelvis the pubis and ischium with flat and expanded ventral surfaces, while the obturator foramen may be completed by the union of the ischium with the pubis of the same side. Limb-bones and vertebral centra with roughened epiphysial terminal surfaces. The humerus may have either an entepicondylar (ulnar) foramen, or an ectepicondylar groove, or both of these together, or neither; and the tarsus may be of a very primitive type. Both pairs of limbs are present, and are generally subequal in length.

Order SAUROPTERYGIA.

Body devoid of exoskeleton; with the neck more or less elongated, and the tail short. Superior temporal arcade present [3]; narial apertures double and more or less approximated to orbit;

[1] Baur (Journ. Morphol. vol. i. p. 97) regards these heads as morphologically double, owing to the union of capitulum and tuberculum.

[2] Huxley, 'Anatomy of Vertebrated Animals,' 1st ed. pp. 206, 222, regards the precoracoidal process of the Lacertian coracoid as homologous with the Chelonian and Amphibian precoracoid.

[3] Huxley, 'Anatomy of Vertebrated Animals,' 1st ed. p. 212, considered that there were two arcades; but Baur, 'Journ. Morphol.' vol. i. p. 97, rightly states that the lower one is wanting

premaxilla very large ; a parietal foramen in the adult ; a transverse bone ; a distinct prefrontal ; postorbital in some cases separate from postfrontal ; and mandibular symphysis uniting by suture. Teeth with sharp curved crowns and fluted enamel ; implanted in distinct sockets, and confined to the margins of the jaws. Each rib articulating to a single vertebra : and in the cervical region the costal facets single or double ; caudal ribs present. Vertebræ amphicœlous, with the neuro-central suture persistent or obliterated ; costal articulations on the centra of the cervicals and caudals, and on the arches of the dorsals [1] ; the latter usually having distinct transverse processes. Chevrons present. In the pectoral girdle [2] the coracoids uniting in a ventral symphysis ; and the scapulæ either meeting in the median line, or more or less widely separated by the intervention of a single or triple ossification correlated by Hulke with the omosternum ; the clavicles and interclavicles according to this view being wanting. Limbs variable, being apparently adapted in part for progression on land in the more generalized, but converted into paddles in the more specialized forms ; humerus and femur always of considerable length ; phalangeals elongated, and no additional digits developed.

Habits carnivorous ; marine or terrestrial.

A remarkable peculiarity of the limb-bones is worth notice. In the later forms at least the terminal epiphyses of the humerus and femur were enormously developed, forming two cones (fig. 46, p. 149), which may meet at their apices in the middle of the bone, and thus reduce the shaft to what may be described as a pair of cups united together at their bases, and having deeply conical cavities.

The skull has a parieto-squamosal (post-temporal) bar.

[1] The vertebræ in which the costal articulation is partly on the arch and partly on the centrum may be termed "pectoral" in the anterior, and lumbo-sacral or lumbar in the posterior region of the column.

[2] Great difference of opinion has arisen in the interpretation of the pectoral arch. Seeley regards the portion here termed omosternum as the clavicle and interclavicles, and considers, with Huxley, that the whole of the bone here termed scapula really is so. Hulke, however, Proc. Geol. Soc. for 1883, pp. 45–50, regards the ventral plates (*pc.* or *p.cor.* of figures) of these bones as corresponding to the precoracoid of the Chelonia ; a correlation which is somewhat difficult to accept in view of their absence in *Nothosaurus*. The deep-seated position of the bones termed omosternum appears to be in favour of Hulke's interpretation. The suggestion that the ventral plates of the scapulæ are clavicular is clearly untenable.

Family PLESIOSAURIDÆ.

In the skull (when known) the pterygoids diverging posteriorly; a small infraorbital foramen on either side of the palate[1]. Pectoral vertebræ with a single costal articulation lying partly on the arch and partly on centrum; dorsals with long transverse processes. Scapulæ with large ventral (precoracoidal) plates; coracoids with very long median symphysis, extending up to or in advance of scapular articulation. Pubis without foramen. Humerus and femur of moderate length and much expanded distally, without foramen or groove; both these bones (propodials) much larger than epipodials (radius and ulna, and tibula and fibula), which are more or less laterally expanded; phalangeals increased beyond the normal number, without terminal claws. Limbs probably invested in a common integument, and serving as paddles.

The humerus and femur may articulate distally with three bones, of which the serial homology is the same as in the Ichthyopterygia (*suprà*, p. 5).

This family is divided by Seeley[2] into the *Pliosauridæ*, *Elasmosauridæ*, and *Plesiosauridæ*, and if it be considered desirable to split up the genera here adopted some such division would be then necessary.

Genus **PLIOSAURUS,** Owen[3].

Syn. *Ischyrodon*, Meyer[4].
Spondylosaurus, Fischer[5].
Liopleurodon, Sauvage[6].

Skull relatively very large, elongated, with moderately long mandibular symphysis, which usually extends to the 7th tooth[7], and the premaxillary and opposing lower teeth enlarged. Teeth large and stout, with strongly marked ridges, and generally a pair of carinæ, which are frequently separated by a smooth space. Neck

[1] In the skull of *Thaumatosaurus megacephalus* figured by Sollas in the 'Quart. Journ. Geol. Soc.' vol. xxxvii. p. 472, fig. 8, the bones marked as palatines (*Pl.*) are really the pterygoids, which reach forward in the usual manner to articulate with the vomer, as in the skull of *Plesiosaurus dolichodirus*, No. 41101 (*infrà*).

[2] Quart. Journ. Geol. Soc. vol. xxx. pp. 445, 449.

[3] Odontography, pt. ii. p. 282 (1841).

[4] Neues Jahrb. 1838, p. 414.—Description insufficient.

[5] Bull. Soc. Moscou, vol. xviii. pt. i. p. 343 (1845).

[6] Bull. Soc. Géol. France, sér. 3, vol. i. p. 377 (1873).

[7] In the figure of *P. brachydirus* given by Phillips the postsymphysial portion of the mandible has been crushed together, so as to make the symphysis appear longer.

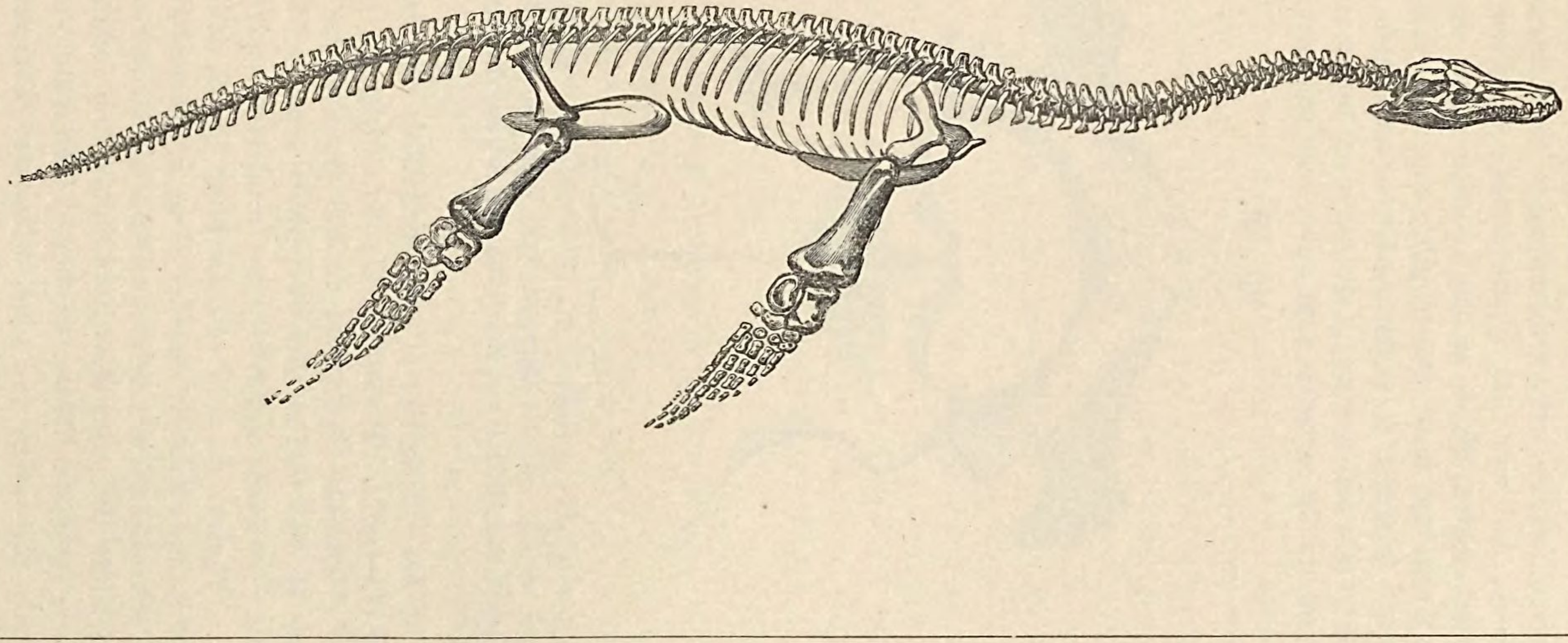
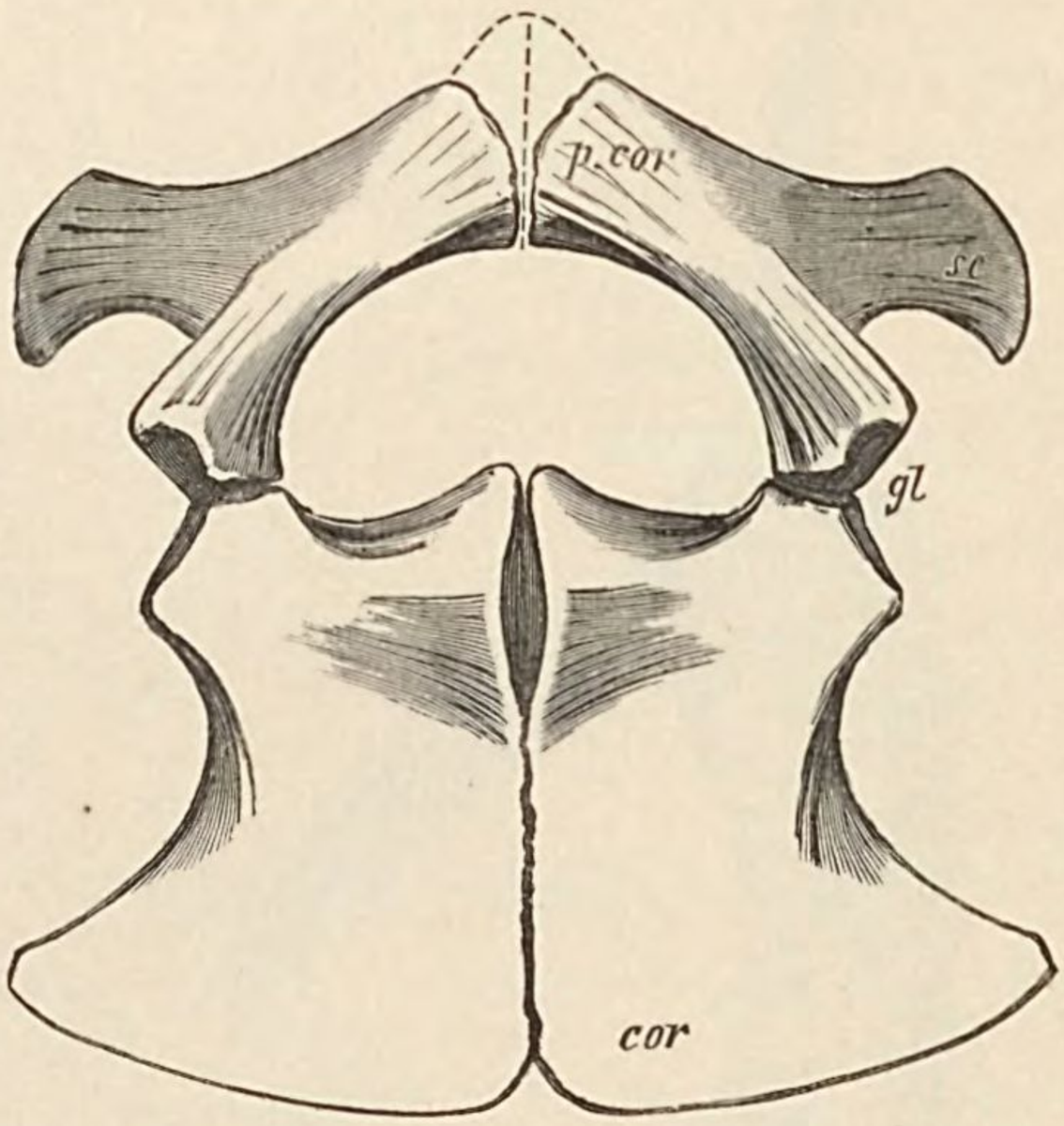


Fig. 35.—*Plesiosaurus* (*cf.*) *macrocephalus*.—Restoration of the skeleton; from the Lower Lias of Dorsetshire. Greatly reduced. (*After Owen.*)

short, with the anterior vertebræ large. Vertebræ with the arches and cervical ribs articulating to the centrum only by synchondrosis, and with flat zygapophyses; cervicals (fig. 38) with very short centra, which in the anterior region carry two distinct costal facets and have very slightly cupped terminal faces, but in the posterior region have flattened faces and single facets; dorsals with flat faces and a forward overhang of upper part of centrum. Centra of middle cervicals with subcylindrical terminal faces, but

Fig. 36.



Restoration of the pectoral girdle of *Pliosaurus*. Reduced. *sc*, scapula; *p.cor*, ventral (precoracoidal) plate of do.; *gl*, glenoid cavity; *cor*, coracoid. The scapula is taken from No. 31933 (p. 143), and the coracoid from that of *P. evansi*.

those at the extremities of the series with the same faces transversely elliptical [1]. Pectoral girdle (fig. 36) of the general type of that of *Peloneustes* (*infrà*), the ventral plates of the scapulæ either meeting in the median line or perhaps separated by a small omosternum; coracoids apparently not produced in advance of glenoid cavity. Ventral plates of scapulæ large, broad, and flat, the dorsal portion being relatively smaller than in *Thaumatosaurus* (*infrà*). In the pelvis the pubis nearly square; ischia elongated (as in fig. 44). In the adult the pubis may have joined the ischium to form an obturator foramen. Humerus shorter than femur, and articulating with only the radius and ulna, which are shortened, oblong, and separated by a very small interval.

[1] This character is shown by some associated series in the Woodwardian Museum, Cambridge.

It may be observed that in young individuals the terminal faces of the cervical vertebræ are much flatter than in the adult; and the ischia (fig. 44) are less elongated.

There has been considerable confusion as to the species which should be regarded as the type of this genus. Thus on page 51 of the 'Proc. Geol. Assoc.' for 1883 it is stated by Hulke that the genus was formed by Owen in the 'Rep. Brit. Assoc.' for 1841, pp. 60–63 (1842), for the reception of the two species originally designated by him *Plesiosaurus grandis* and *Plesiosaurus trochanterius*. A reference to pp. 64, 65 of the 'Rep. Brit. Assoc.' *tom. cit.* shows, however, that this is a misapprehension, and that the type is undoubtedly the imperfect skeleton in the Oxford Museum from the Kimeridge Clay of Market-Rasen, Lincolnshire, originally described under the name of *Pliosaurus brachydirus* in Owen's 'Odontography,' pt. ii. (1841). Owen himself has, however, shifted his ground, since, in his 'Fossil Reptilia of the Kimeridge Clay' (Mon. Pal. Soc.), pt. iii. p. 6 (1869), he takes the name *Pliosaurus grandis* for the type of the genus, and suggests that *P. brachydirus* is merely a variety of the same. This departure from the original view is, however, inadmissible; and there is, moreover (as Hulke has pointed out), no evidence to show that the humerus or femur on which *Plesiosaurus grandis* was founded does really belong to that genus.

Pliosaurus brachydirus, Owen [1].

Syn. *Plesiosaurus giganteus,* Conybeare [2].

The type species. Considerably smaller than *P. macromerus*. Teeth (fig. 37) with the carinæ strongly developed, and the intercarinal space large and flat, without any trace of vertical ridges; 35 teeth in lower jaw, and mandibular teeth increasing in size till the 12th cervical vertebræ without bevelled edges to the terminal faces of the centra, with the costal facets moderately prominent, unequal, and not deeply excavated; and in the anterior region with a mammilla surrounding the central puncture; texture of bone very fine and smooth. Humerus and femur with small proximal trochanter; femur with the shaft suddenly contracted in the middle, and expanding gradually at both extremities.

The dimensions of one of the later cervical vertebræ of the type skeleton are:—length 0,041 (1·6 inches), height 0,086 (3·4 inches), and width 0,099 (3·9 inches); the length being less than half the width.

All the known examples are from the Kimeridge Clay.

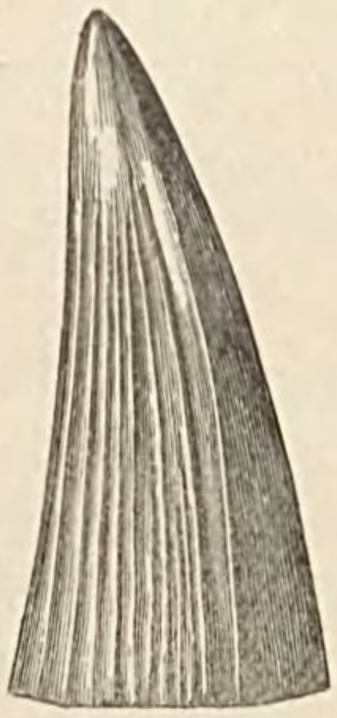
Hab. Europe (England).

[1] Odontography, pt. ii. p. 283 (1841).

[2] Trans. Geol. Soc. ser. 2, vol. i. pt. ii. p. 389 (1824).—Insufficiently characterized.

46796. A considerable portion of the skeleton; from the Kimeridge Clay of Swindon, Wiltshire. The bones remaining are as follows:—The nearly entire mandible, with the anterior portion of the cranium in apposition. The centra of two cervical and of two anterior dorsal vertebræ, and the neural arches and spines of two vertebræ. Fragments of the pectoral girdle: the imperfect humerus of either side; the somewhat imperfect femora; the united tibia and fibula of one side; the tibia of the opposite side; and a number of

Fig. 37.



Pliosaurus (*cf.*) *brachydirus*.—The crown of a tooth; from the Kimeridge Clay of Ely. $\frac{1}{2}$.

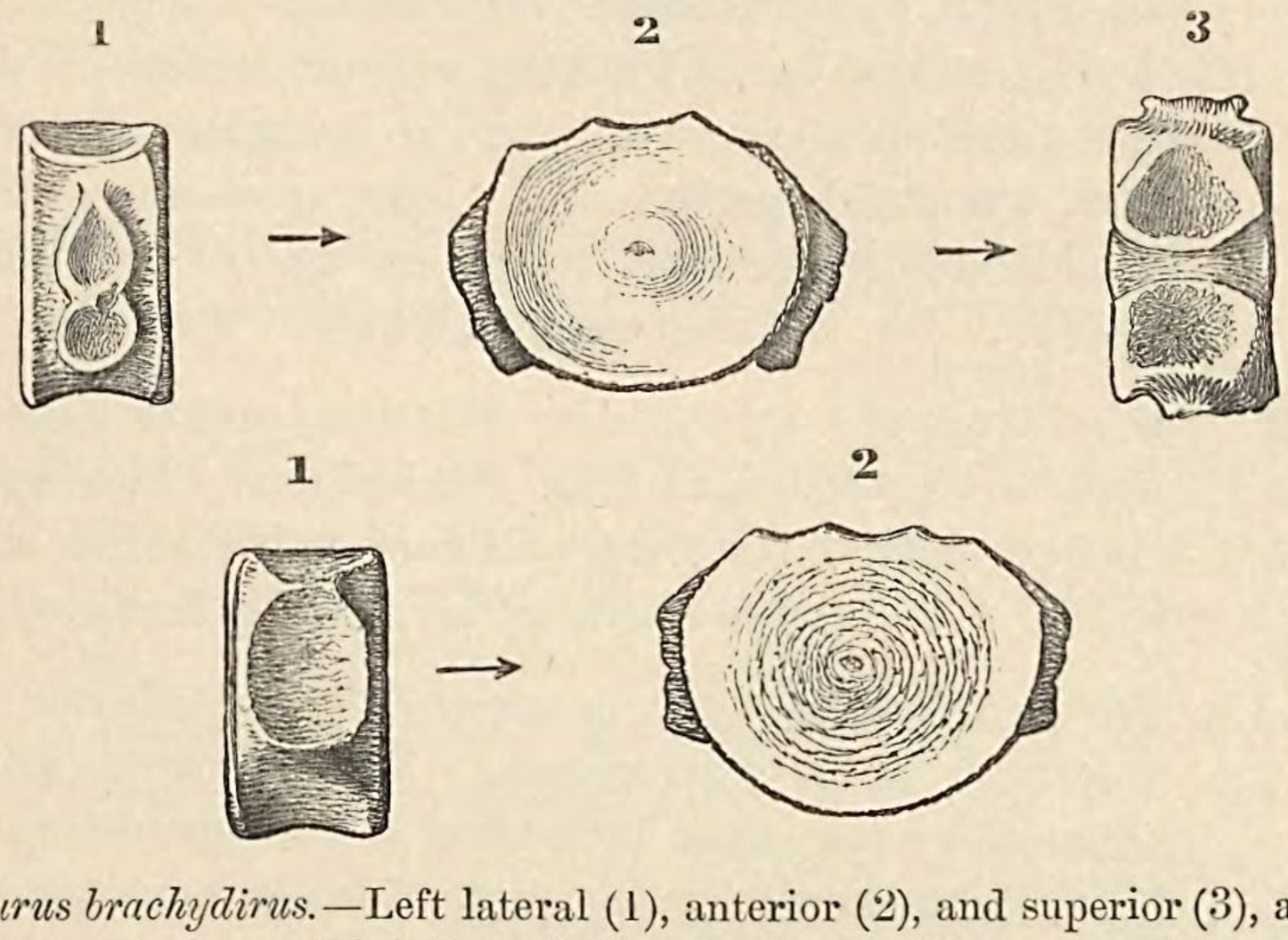
tarsal and a few phalangeal bones. Compared with the bones of the type skeleton figured by Phillips in his 'Geology of Oxford,' pp. 342 *et seq.*, the following points may be noticed. The total length of the mandible is a little short of five feet, about one fifth[1] of this length being formed by the symphysis; and these dimensions coincide very closely with those of the type mandible. The number of the teeth cannot be determined. One of the cervicals (*b*) is from the middle region of the neck, and, although much broken, shows that the contour of the terminal faces was subcircular. The second cervical (*a*), which is also crushed, has its terminal faces transversely ellipsoidal, and appears to have been later in the series; it apparently closely resembles the type anterior cervical represented in fig. 38, showing the strongly marked mammilla. The dorsal agrees with the specimen figured by Phillips on p. 346; its length being 0,065 (2·6 inches), and the width 0,105 (4·2 inches). The femur and tibia seem also to agree precisely with the corresponding bones of the pelvic limb figured by Phillips on p. 352.

Cunnington Collection. Purchased, 1875.

[1] See note 7, p. 120.

41776 a. The centrum of a posterior cervical vertebra in a somewhat crushed condition; from the Kimeridge Clay of Weymouth, Dorsetshire. Length 0,050 (2 inches), height 0,082 (3·24 inches), width 0,108 (4·25 inches). The costal facet appears to be single, and the specimen closely resembles the posterior cervical represented in fig. 38; the contour of the terminal face is ellipsoidal, and there is no mammilla round the median pit. *Purchased*, 1867.

Fig, 38.



Pliosaurus brachydirus.—Left lateral (1), anterior (2), and superior (3), aspects of an anterior, and left lateral (1) and anterior (2) aspects of a posterior cervical centrum; from the Kimeridge Clay of Market-Rasen. $\frac{1}{5}$. (*After Phillips.*)

42282. The centrum of a later cervical vertebra; from the Kimeridge Clay of the Isle of Portland, Dorsetshire. Length 0,060 (2·35 inches), width 0,100 (3·95 inches), height 0,078 (3·15 inches). The upper part of the costal facet impinges on the facet for the arch. *Purchased*, 1869.

24684. The centrum of a dorsal vertebra probably belonging to this species; from the Kimeridge Clay of Wootton-Bassett, Wiltshire. Length 0,083 (3·24 inches), height 0,096 (3·34 inches), width 0,115 (4·5 inches). The base of the neural canal is comparatively wide, moderately contracted in its anterior third, and slightly expanded posteriorly. This specimen closely resembles the dorsal from Shotover figured by Phillips on p. 346 as probably belonging to this species; and agrees in relative size with the preceding vertebra. *Cunnington Collection. Purchased*, 1849.

32703. The centrum of a smaller dorsal vertebra, agreeing in general characters with the preceding, and perhaps belonging to a small individual of this form; from the Kimeridge Clay, locality unknown, but not improbably foreign. The base of the neural canal is imperfect, but the coarser structure of the bone distinguishes it from the equal-sized immature dorsal No. 20280 (p. 142).

Tesson Collection. Purchased, 1857.

24805. The centrum of a lumbar (?) vertebra agreeing in size with No. 24684, and provisionally referred to this species; from the Kimeridge Clay of Foxhangers, near Devizes, Wiltshire. The base of the neural canal is hourglass-shaped, and most expanded posteriorly. The specimen presents a considerable resemblance to the one figured by Phillips on p. 347. *Cunnington Collection. Purchased*, 1849.

46467. The centrum of a very similar vertebra, probably associated with the preceding; from Foxhangers. The specimen appears to have been rather later in the series than the last. *Cunnington Collection. Purchased*, 1875.

24805 a. The centrum of what is apparently an anterior caudal vertebra; from Foxhangers. This specimen doubtless belonged to the same individual as the preceding. The base of the neural canal in place of being hourglass-shaped has become long and narrow, with slight terminal expansions. *Cunnington Collection. Purchased*, 1849.

R. 205. An associated series of centra of lumbar and caudal vertebræ probably belonging to this species; from the Kimeridge Clay of Kimeridge Bay. These specimens agree in relative size with Nos. 42282, 41776 *a*, and resemble those figured on p. 347 of Phillips's 'Geology of Oxford' (fig. 141 being turned the wrong way up).

Fox Collection. Purchased, 1882.

The following specimens are provisionally referred to this species, since they apparently agree in relative size with the vertebræ.

R. 287. The right scapula; from the Kimeridge Clay of Shotover, near Oxford. This bone has the same general contour as the immature scapula No. 31933 (p. 143), but the symphysial portion of the ventral plate is more expanded antero-posteriorly, a character which may be due to the adult condition of the present specimen. The diameter

from the glenoid cavity to the middle of the median symphysis is 0,407 (16 inches) and the vertical diameter of the ventral plate 0,300 (11·8 inches).

Egerton Collection. Purchased, 1882.

31801. The glenoidal portion of the left coracoid; from Shotover. So far as can be determined, this specimen closely resembles the fragments of the coracoids of No. 46796; and it also approximates to the coracoid of *P. evansi*, figured by Seeley in the 'Quart. Journ. Geol. Soc.' vol. xxxiii. p. 722 (as an ischium). The diameter of the humeral and scapular articulations is 0,216 (8·5 inches), or slightly longer than *P. evansi*. *Purchased. About* 1852.

31927. A bone which is apparently the head of an ischium and was probably associated with the preceding; from Shotover. *Purchased. About* 1852.

47324. The right humerus; from the Kimeridge Clay of Swindon. The postaxial border of the distal extremity is imperfect; the length is 0,584 (23 inches). This specimen accords very closely with the imperfect humeri of No. 46796, and also agrees with the description of the corresponding bone of the type skeleton given by Phillips on p. 352.

Presented by the Directors of the Swindon Brick and Tile Company, 1876.

Teeth, of which some probably belong to the present form, while others may be referable to P. macromerus.

44600. A crushed tooth of medium size; from Swindon. The crown is relatively short. *Presented by the Directors of the Swindon Brick and Tile Company,* 1873.

46329. The crown of a larger tooth; from Devizes. This agrees nearly in size with the lower tooth of the type specimen figured in Owen's 'Odontography,' pl. lxviii. fig. 5.

Cunnington Collection.

46329 a. The crown of an equally long, but more slender tooth; from Devizes. *Cunnington Collection.*

47958. The crown of a tooth closely resembling No. 46329, but somewhat taller; from Shotover.

Presented by the Hon. R. Marsham, 1877.

40109. An imperfect smaller tooth; from Shotover. *Purchased.*

43071. (*Fig.*) The crown of a medium-sized tooth; from Ely. Figured in woodcut, fig. 37. The base has been polished.
Purchased, 1871.

43071 a. The crown of a tooth, agreeing nearly in size with the preceding; from Ely. The ridges are very closely approximated. Part of one side has been polished.
Purchased, 1871.

43071 b. The summit of the crown of a very similar tooth; from Ely. The base has been polished. *Purchased*, 1871.

20282. The crown of a medium-sized tooth, of very slender form; from Ely. *Purchased*, 1846.

39790. The basal half of the crown of a very similar tooth; from the Kimeridge Clay, locality unknown.
Bowerbank Collection. *Purchased*, 1865.

28111. The crown of a tooth closely resembling No. 20282; from Ely. *Presented by James Carter, Esq.*, 1852.

R. 1251. The crown of a smaller tooth; from Ely.
Presented by R. Lydekker, Esq., 1888.

42371–2. The crowns of three very small teeth; from the Kimeridge Clay of Weymouth, Dorsetshire. *Purchased*, 1870.

43029. The crowns of two medium-sized teeth, one imperfect; from Weymouth. *Purchased*, 1871.

R. 1272. The crown of a large tooth; from the Kimeridge Clay of Marcham, near Abingdon, Oxfordshire.
Harford Collection. *Purchased*, 1888.

Pliosaurus evansi, Seeley[1].

Of small size. Teeth not improbably of the type described as *P. grossouvrei*. Cervical vertebræ (fig. 39) 19 or 20 in number, of the general type of those of the preceding species, but the anterior ones with a hæmal carina, and with the edges distinctly bevelled and the mammilla slightly developed or absent.

In the fourth cervical of the type (fig. 39) the length is 0,035 (1·4 inches), height 0,059 (2·3 inches), width 0,071 (2·8 inches); the length being half the width. The atlas and axis of the type specimen are not anchylosed together. The bone figured by Seeley in the 'Quart. Journ. Geol. Soc.' vol. xxxiii. p. 722, fig. 7, as an ischium, but identified with the coracoid in the 'Geol. Mag.' dec. 3, vol. iv. pp. 478, 479 (1887), is represented in woodcut fig. 36, and is of

[1] Index to Aves &c. in Cambridge Museum, p. 116 (1869).

the general type of the corresponding bone of *Peloneustes philarchus*. This species may have been the ancestor of the preceding.

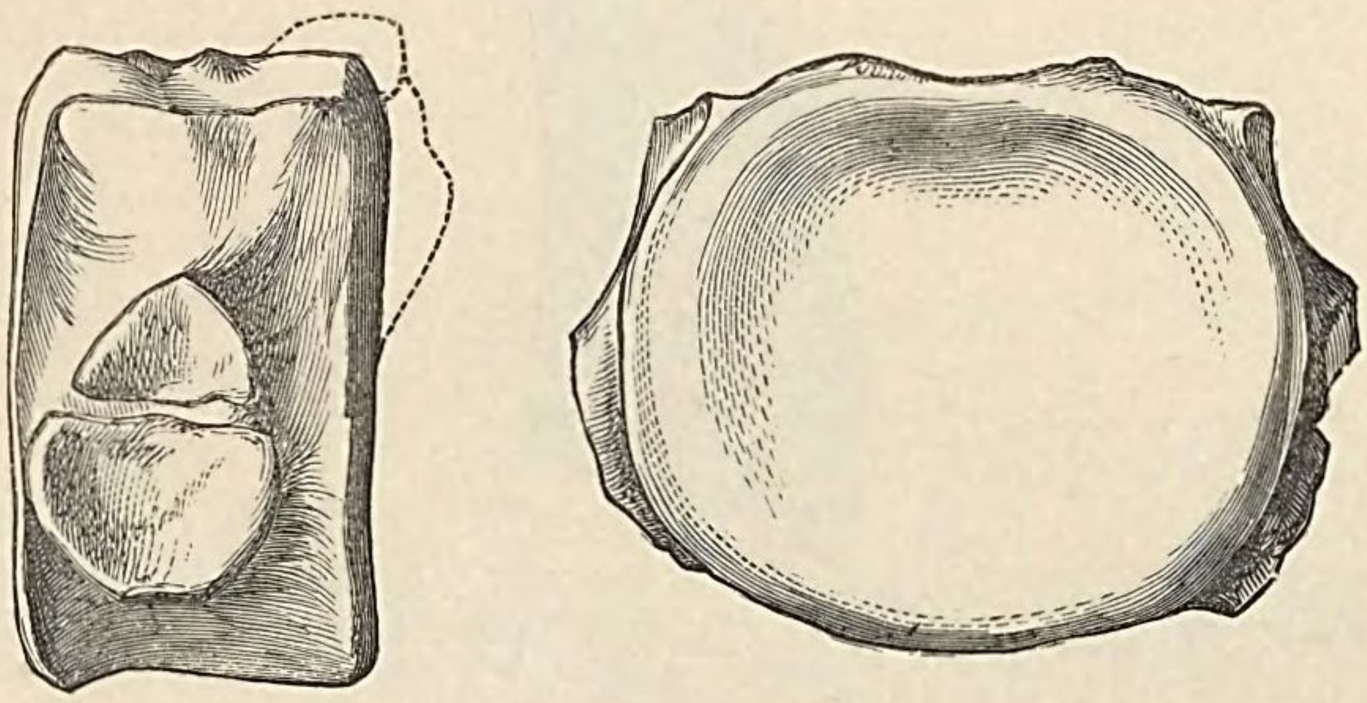
The probability of this species being identical with the French and Russian forms noticed under the name of *P. grossouvrei* is mentioned under that heading.

Hab. Europe (England).

47837. Cast of the atlas and axis vertebræ, with the first intercentrum. The original, which belongs to the type skeleton, was obtained from the Oxford Clay (Middle Jurassic) of Eynsbury, near St. Neots, Huntingdonshire; and is preserved in the Woodwardian Museum, Cambridge. The specimen is noticed by Seeley in his 'Index to Aves &c. in the Cambridge Museum,' p. 116, and described and figured in the 'Quart. Journ. Geol. Soc.' vol. xxxiii. pp. 716, 717, figs. 1, 2. The atlas and axis are not anchylosed together.

Presented by Prof. H. G. Seeley, 1876.

Fig. 39.



Pliosaurus evansi.—Right lateral and anterior aspects of the centrum of the fourth cervical vertebra; from the Oxford Clay of Huntingdonshire. $\frac{1}{2}$ nat. size. (From the 'Quart. Journ. Geol. Soc.')

R. 1243. The centrum of a middle cervical vertebra; probably from the Oxford Clay, locality unknown. Length 0,040 (1·58 inches), height 0,076 (3·0 inches), width 0,081 (3·18 inches). The contour of the terminal faces is subcircular, and the edges are distinctly bevelled; the upper costal facet is connected by a ridge with the facet for the neurapophysis, and there is no hæmal carina. This specimen, which presents every appearance of being adult, cannot be distinguished from the middle cervicals of the type.

No history.

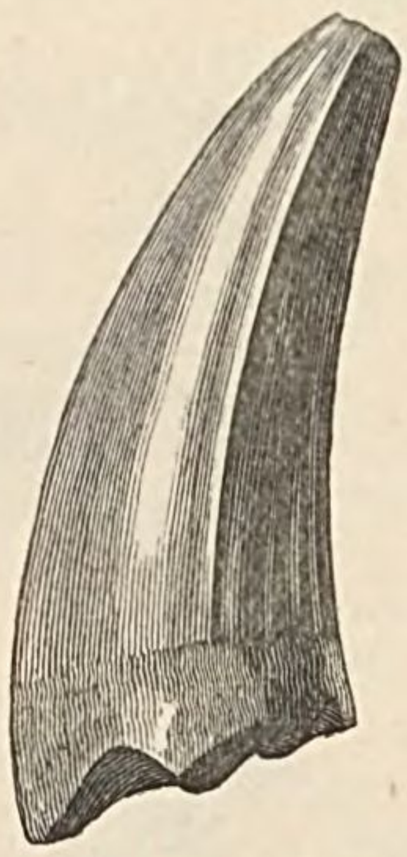
** **Pliosaurus grossouvrei** (Sauvage[1]).

Syn. *Liopleurodon grossouvrei*, Sauvage[2].
? *Spondylosaurus fearsi*, Fischer[3].
(?) *Pliosaurus wosinskii*, Fischer[4].

Founded upon teeth (fig. 40), in which the smooth surface is convex from side to side, and the carinæ are not very prominent. The hinder teeth (judging from the next form) had no carinæ and were ridged on all sides.

These teeth, which approximate in structure to those of *Peloneustes philarchus*, are very probably specifically identical with *P. evansi*. The type specimen is from the Kelloway Rock (Middle Jurassic).

Fig. 40.



Pliosaurus grossouvrei.—Crown of a tooth; from the Coral Rag of Wiltshire. $\frac{1}{1}$.

Spondylosaurus fearsi was founded upon two late cervical vertebræ of a small Pliosaur from the Jurassic of Russia, which are probably specifically the same as the teeth from the same deposits subsequently described under the name of *Pliosaurus wosinskii*. The latter closely resemble those of the present form. If all the above-mentioned forms be specifically the same, the name *fearsi* has the right of priority. *S. fearsi* is the type of the genus *Spondylosaurus*.

Hab. Europe (France, England, and [?] Russia).

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[1] Bull. Soc. Géol. France, sér. 3, vol. i. p. 379 (1873).—*Liopleurodon*.
[2] *Loc. cit.*
[3] Bull. Soc. Moscou, vol. xviii. pt. i. p. 350 (1845).
[4] *Ibid.* vol. xix. pt. ii. p. 105 (1846).

47044. The crown of a medium-sized tooth; from the Coral Rag (Middle Jurassic) of Heddington, Wiltshire. This specimen (woodcut fig. 40), although of rather smaller size, agrees precisely with the type tooth figured by Sauvage in the 'Bull. Soc. Géol. France,' sér. 3, vol. i. pl. vii. fig. 2.
(*Fig.*)
Brown Collection. Presented by Sir R. Owen, K.C.B., 1852.

36335. The crown of a larger tooth; from the Coral Rag of Malton Yorkshire.
Purchased, 1862.

36335 a. Fragment of rock showing the concave surface of the crown of a similar tooth; from Malton. *Purchased*, 1862.

36335 b. Fragment of rock exhibiting the convex surface of the crown of a similar tooth; from Malton. *Purchased*, 1862.

36335 c. An imperfect tooth of larger size, in matrix; from Malton
Purchased, 1862.

36335 d. The crown of a small and short tooth; from Malton.
Purchased, 1862.

36335 e. The crown of a still smaller tooth; from Malton.
Purchased, 1862.

47971. The crowns of two medium-sized teeth; from the Coral Rag of Wheatley, Oxfordshire.
Presented by the Hon. R. Marsham, 1877.

47971 a. The crowns of two teeth of somewhat smaller size than the preceding; from the Coral Rag of Wheatley.
Presented by the Hon. R. Marsham, 1877.

Pliosaurus macromerus, Phillips [1].

Syn. (?) *Ischyrodon meriani*, Meyer [2].
Pliosaurus grandis, Owen [3].
Pliosaurus giganteus, Wagner [4].

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[1] Geology of Oxford, p. 354 (1870).

[2] Neues Jahrb. 1838, p. 414. Although the tooth was figured before the publication of Phillips's name it is insufficient for specific diagnosis.

[3] Kimeridge Clay Reptilia (Mon. Pal. Soc.), pt. ii. p. 1 (1862).—Identified with *Plesiosaurus grandis*, Rep. Brit. Assoc. for 1839, p. 83.

[4] Abh. k.-bay. Ak. Wiss. vol. vi. pt. 3, p. 696 (1852). Inapplicable on account of *Plesiosaurus giganteus*, Conybeare.

The largest known species. Teeth of the type of those of *P. brachydirus*; apparently 24 in mandible; upper ones increasing in size till the ninth. Centra of cervical vertebra (fig. 41) with the costal facets very prominent, subequal in size, and deeply hollowed, the terminal faces bordered by a groove, and their central puncture usually surrounded by a mammilla; the profile much curved by the overhanging of the upper portion. Early posterior cervicals with a descending projection on anterior border of hæmal surface. Outer surface of vertebræ very coarse and rough. Humerus and femur (fig. 43) with distinct proximal trochanter; shaft (especially in the femur) long, straight, and expanding suddenly at the distal extremity only.

The following are the dimensions of one of the anterior cervical vertebræ figured by Phillips; viz.—Length 0,071 (2·8 inches), height 0,133 (5·3 inches), width 0,143 (5·65 inches).

The specific name was applied to a femur (fig. 43) from the Kimeridge Clay of Swindon, and Phillips provisionally associated with this the largest forms of Kimeridgian vertebræ. That this reference is correct there seems but little doubt; and since all the largest remains from the Kimeridgian agree in relative size with one another, and, so far as comparison is possible, show no well-marked characters by which they can be specifically distinguished, the presumption is that most or all of them belong to a single species, and they are therefore all provisionally referred to the present form. It is however, not improbable that some of the smaller dorsal vertebræ may belong to another form.

The reasons against the employment of the name *P. grandis* have been already mentioned. The type tooth of *Ischyrodon* figured by Meyer in the 'Palæontographica,' vol. vi. pl. ii. figs. 1–3, which was obtained from the Upper Jurassic of Würtemberg, presents all the characters of the teeth of the English Kimeridgian Pliosaurs, and from its large size may be provisionally referred to the present species. If this reference be correct the name *P. meriani* should supersede *P. macromerus*.

Hab. Europe (England [?] France [1], and [?] Würtemberg).

39362. (*Fig.*) The imperfect skull; from the Kimeridge Clay (Upper Jurassic) of Kimeridge Bay, Dorsetshire. The cranium shows the nearly complete palate, but is imperfect superiorly and posteriorly; while the mandible is nearly entire. Figured by Owen, in his 'Reptilia of the Kimeridge Clay' (Mon. Pal. Soc.), pt. iii. pls. i., ii. (1869), as *P. grandis*.

[1] Sauvage, Ann. Sci. Nat., Zool. sér. 6, vol. viii. art. 6, p. 14 (1879).

The dental alveoli are empty, but germ-teeth are shown in a few instances. There are 24 alveoli in each jaw [1]; and in the cranium there are five teeth in the premaxilla, then there is a gap in the series, beyond which the teeth increase in size till the ninth. The length of the ramus of the mandible is 1,660 (5 feet 10 inches). This specimen accords so well in relative size with the type femur that there is every reason for referring it to the same species. *Presented by J. C. Mansel-Pleydell, Esq.*, 1865.

32775. Fragment of a cranium apparently belonging to this species; from the Kimeridge Clay of Boulogne, France. This specimen apparently comprises the region immediately behind the 11th tooth, and shows four dental alveoli on the right and three on the left side; it indicates a larger individual than the preceding specimen. *Purchased.*

37408. (*Fig.*) An entire tooth, with the root somewhat crushed; from Kimeridge Bay. Figured by Owen, *op. cit.* pt. ii. pl. xii. (1862), as *P. grandis*. The length of the entire specimen is one foot; its large size indicates that it belongs to the present species.

Presented by J. C. Mansel-Pleydell, Esq., 1863.

47877. (*Fig.*) The imperfect crown and upper portion of the root of an equally large tooth; from the Kimeridge Clay near Oxford. Figured by Owen, *op. cit.* pt. i. pl. vii. (1861), as *P. grandis*.

Presented by the Hon. R. Marsham, 1877.

37311. Cast of an imperfect tooth of nearly equally large dimensions. The original was obtained from the Kimeridge Clay of Ely, Cambridgeshire, and is preserved in the collection of M. Fisher, Esq., at that town.

Presented by R. Stead Jones, Esq., 1863.

37312–13. Casts of the crowns and part of the root of two slightly smaller teeth. The originals were obtained with that of the preceding specimen.

Presented by R. Stead Jones, Esq., 1863.

40304. The crown and upper portion of the root of a tooth of rather smaller size than No. 37408; from the Kimeridge Clay of Hartwell, Buckinghamshire. *Purchased*, 1867.

40304 a. The crown of a rather smaller and apparently associated tooth; from Hartwell. *Purchased*, 1867.

[1] Owen states there are 26 upper and 30 lower teeth.

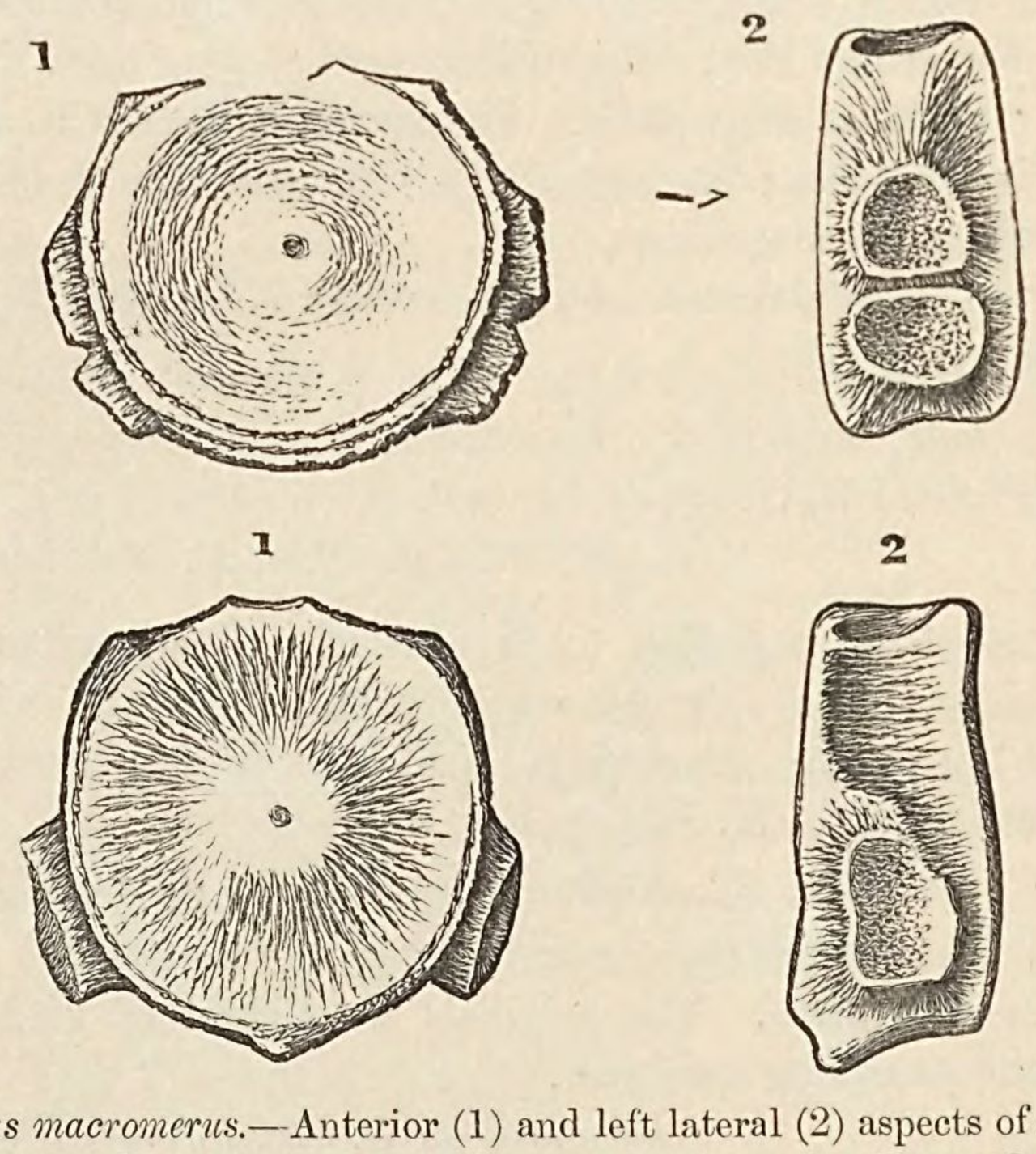
R. 1252. Cast of a tooth which may belong to the hinder part of the upper jaw of this species. The original was obtained from the Kimeridge Clay of Ely, in company with a rather larger tooth of similar type, and is in the collection of Mr. M. Fisher of that town. The length of the crown is 0,080 (3·14 inches), and its basal diameter 0,033 (1·2 inches). The intercarinal portion of the crown is convex, as in all the teeth of *P. grossouvrei*.

Presented by R. Lydekker, Esq., 1888.

40437. The water-worn crown of a slightly larger but otherwise similar tooth; from the Lower Greensand of Potton, Bedfordshire, being probably derived from the Kimeridge Clay.

Purchased, 1867.

Fig. 41.



Pliosaurus macromerus.—Anterior (1) and left lateral (2) aspects of an anterior and an early posterior cervical centrum; from the Kimeridge Clay. $\frac{1}{5}$. (*After Phillips.*)

24684. The centrum of an anterior cervical vertebra; from the Kimeridge Clay of Wootton-Bassett, Wiltshire. Length 0,057 (2·2 inches), height 0,125 (4·95 inches), width 0,130 (5·2 inches). The resemblance of this specimen to the vertebræ described and figured on p. 354 of Phillips's

'Geology of Oxford' (reproduced in the accompanying woodcut), and provisionally referred to the present species, is so close as to leave little doubt of its specific identity.

Cunnington Collection. Purchased, 1849.

24684 a. The centrum of an associated anterior cervical vertebra, with the right costal articulation imperfect.

Cunnington Collection.

24684 b. A similar cervical centrum associated with the preceding.

Cunnington Collection.

46466. The centrum of a cervical vertebra of similar type; from the Kimeridge Clay of Foxhangers, near Devizes, Wiltshire.

Cunnington Collection. Purchased, 1875.

46466 a. The centra of three associated cervical vertebræ of a somewhat smaller individual; from Foxhangers.

Cunnington Collection.

R. 1244. The centrum of an anterior cervical vertebra; from the Kimeridge Clay of Wiltshire. *No history.*

R. 6. The centrum of a very large anterior cervical vertebra; found in the drift at Stanton, near Bury-St.-Edmunds, Suffolk. Length 0,060 (2·4 inches), height 0,158 (6·1 inches), width 0,165 (6·55 inches). These dimensions exceed those of either of the specimens figured by Phillips.

Purchased, 1880.

24684 c. The centrum of a middle cervical vertebra of a comparatively small individual; from Wootton-Bassett. The contour of the centrum is very similar to that of the larger example figured by Phillips, *op. cit.* p. 355, fig. 149; but the two costal facets have not completely coalesced.

Cunnington Collection. Purchased, 1849.

44117. The centrum of a later cervical vertebra belonging to a large individual; from the Kimeridge Clay of Motcombe, near Shaftesbury, Dorsetshire. The inferior costal facet has nearly disappeared, and the terminal faces have become nearly flat.

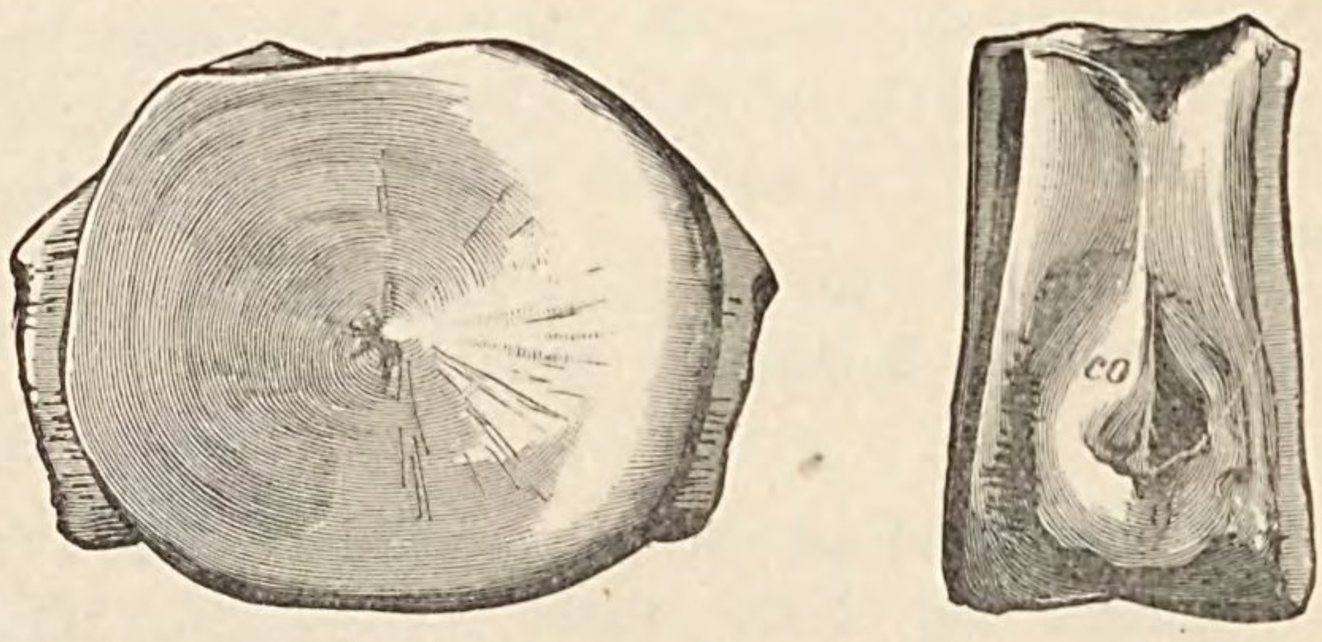
Presented by Sir Philip de Malpas Grey Egerton, Bart.

R. 1278. The centrum of a late posterior cervical vertebra, probably referable to this species; from Kimeridge Bay. Figured in the accompanying woodcut. Length 0,079 (3·1 inches), height 0,114 (4·5 inches), width 0,150 (5·9

inches). The costal facet is single and placed higher on the centrum than in the specimen represented in fig. 41, and the terminal faces have become ellipsoidal. The edges of the latter are bordered, there is no mammilla surrounding the median pit, and the base of the neural canal is much expanded posteriorly.

Presented by J. C. Mansel-Pleydell, Esq., 1888.

Fig. 42.



Pliosaurus (*cf.*) *macromerus*.—Anterior and left lateral aspects of a late posterior cervical vertebra; from the Kimeridge Clay of Kimeridge Bay. About $\frac{1}{4}$. *co*, costal facet.

R. 1278 a. Two centra of "pectoral" vertebræ associated with the preceding. The terminal faces have the same ellipsoidal contour. *Presented by J. C. Mansel-Pleydell, Esq.*, 1888.

R. 1246. The centrum of a dorsal vertebra agreeing with the specimen figured by Phillips, p. 356, fig. 150, and referred to the present species; from the Kimeridge Clay of Gillingham, Dorsetshire. Length 0,108 (4·25 inches), height 0,157 (6·2 inches), width 0,159 (6·3 inches). The base of the neural canal is narrow, and moderately expanded at the two extremities. *Acquired about* 1868.

46795 d. The centrum of a later dorsal vertebra, agreeing very closely in size with the preceding; from Wootton-Bassett. The neural suface is imperfect; and the mammillæ in the centre of the terminal faces, so strongly marked in the preceding specimen, are very indistinct.

Cunnington Collection. Purchased, 1875.

R. 1247. The crushed centrum of a dorsal vertebra, agreeing in size with the preceding; from the Kimeridge Clay of Wiltshire. *No history.*

R. 1247 a. A similar specimen, apparently associated with the preceding. *No history.*

31923. An imperfect centrum closely resembling No. 46795 *d*; from the Kimeridge Clay of Shotover, Oxfordshire. *Purchased.*

40406. The centrum of a dorsal vertebra resembling No. R. 1246, but of rather smaller size; from the Kimeridge Clay of Ilminster, Somersetshire.

Presented by Sir R. Owen, K.C.B.

46796 b. A very similar specimen; from Devizes.

Cunnington Collection.

24684 d. A similar centrum; from Wootton-Bassett.

Cunnington Collection. Purchased, 1849.

24684 e. The imperfect centrum of a dorsal vertebra apparently resembling No. 46795 *d*; from Wootton-Bassett.

Cunnington Collection.

46796 c. The centrum of a dorsal vertebra of similar type; from Devizes. This imperfect specimen has been vertically and longitudinally bisected.

Cunnington Collection. Purchased, 1875.

47988. The centrum of a smaller dorsal vertebra, perhaps belonging to this form; from Shotover.

Presented by the Hon. R. Marsham, 1877.

46796 d. The centrum and base of one side of the neural arch of what is either a "pectoral" or a lumbar vertebra; from Devizes. Probably associated with No. 46796 *c*.

Cunnington Collection.

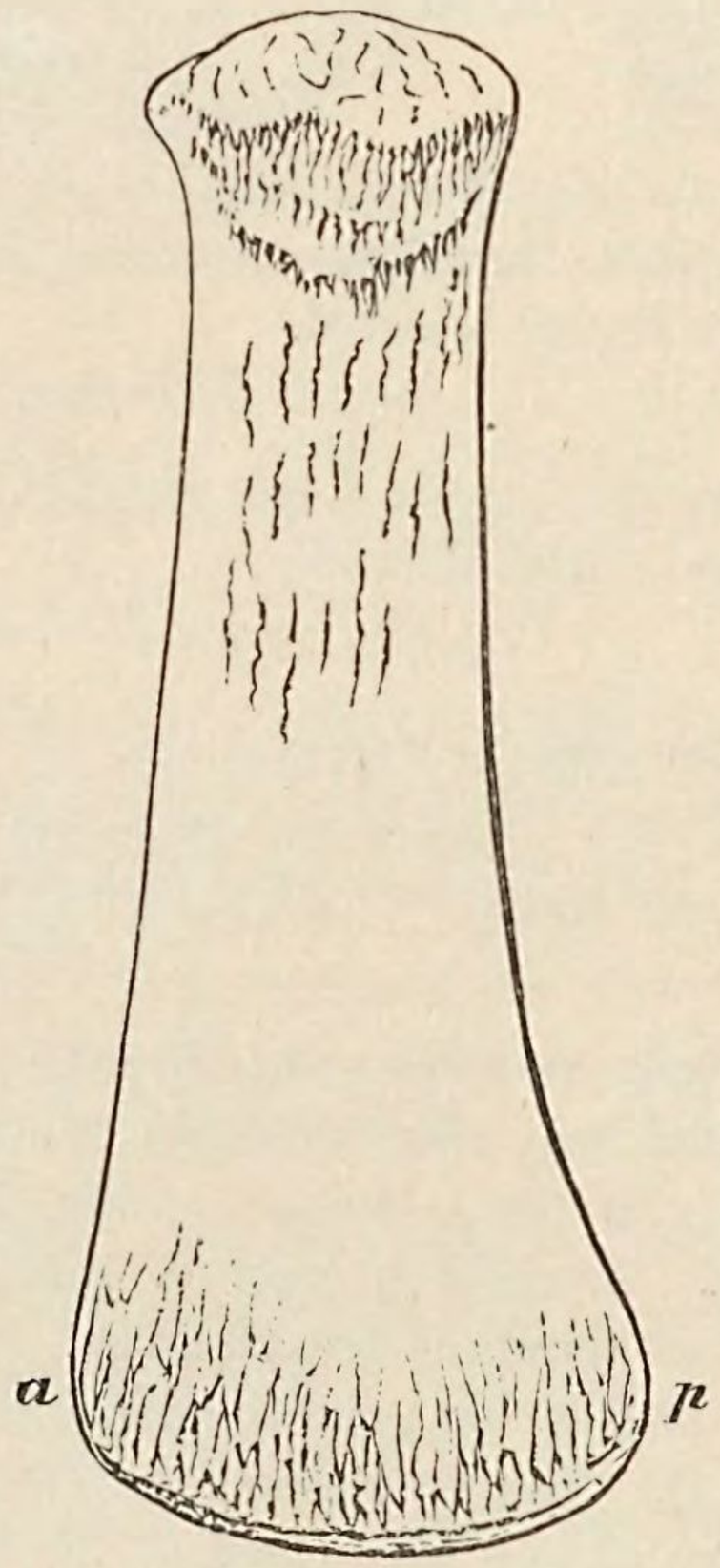
R. 926. Cast of a right humerus probably referable to this species. The original was obtained from the Kimeridge Clay of Ely, and is in the collection of Mr. Marshall Fisher of that town. A small portion of the postaxial border of the distal extremity is broken away. The extreme length is 0,724 (28·4 inches), and the distal diameter about 0,330 (13 inches). The dimensions and contour of this bone accord very closely with those of the humerus figured by Phillips on p. 363 as *P. brachydirus*, but which is much larger than the femur of that form, and is in all probability referable to the present species.

Presented by R. Stead Jones, Esq., 1863.

R. 1250. A somewhat smaller example of the corresponding bone; from the Kimeridge Clay, locality unknown. Length 0,644 (25·4 inches), diameter of distal extremity 0,265 (10·4 inches). *Purchased.*

R. 1245. Cast of the bones of the right (?) pelvic limb, apparently seen from the inner side. The original was obtained from Kimeridge Bay by Mr. Mansel-Pleydell, and is preserved in the Museum at Dorchester. The femur wants a portion of the distal postaxial border; and the arrangement of some of the bones is incorrect. The entire length as restored is 1,960 (6 feet 6 inches); the length of the femur being 0,930 (37 inches), and its width in the middle of the shaft 0,170 (7 inches). The resemblance to the type femur figured on p. 362 of Phillips's 'Geology

Fig. 43.



Pliosaurus macromerus.—Dorsal aspect of the left femur; from the Kimeridge Clay of Swindon. $\frac{1}{10}$. *a*, preaxial, *b*, postaxial border. (*After Phillips.*)

of Oxford' (reproduced in fig. 43) is very close; the length of that specimen being 0,853 (34 inches), the width in the

middle of the shaft 0,172 (7·25 inches), and the width of the distal extremity 0,316 (12·75 inches); it is probable, however, that a portion of the postaxial border is wanting at the distal extremity; since in a specimen in the collection of Mr. M. Fisher, of Ely, the length is 0,936 (37 inches), and the distal diameter about 0,430 (17 inches). Phillips notices the present specimen on p. 357 under the name of *P. grandis*, as indicating a form closely allied to the type femur, but mentions a difference at the distal extremity of the femur, which, however, may perfectly well be due to imperfection or to the effects of pressure. Mention is also made of this specimen by Hulke in the 'Quart. Journ. Geol. Soc.' vol. xxvi. pp. 620, 621, where it is suggested that a third bone may have articulated with the femur; a view which is not supported by the limbs of *Peloneustes philarchus*.

Purchased.

47884. A tibia and the inner half of an associated fibula; from Shotover. Transverse diameter of tibia 0,180 (7·1 inches), vertical 0,100 (3·95).

Presented by the Hon. R. Marsham, 1877.

46469. A tibiale; from Devizes. *Same history.*

32500. Cast of a very large pubis. The original was obtained from the Kimeridge Clay of Ely, and is in the collection of Mr. Fisher. The antero-posterior diameter is about 0,660 (26 inches); and the specimen presents the squared contour characteristic of the genus. An ischium from the same deposit preserved in the same collection has a length of 0,556 (22 inches), and a diameter of 0,443 (17·5 inches) at the proximal extremity; it would agree in relative size with this pubis, and has the same contour as the ischium of *Peloneustes æqualis*.

Presented by George Baird, Esq., 1857.

Remains of Immature Pliosaurs.

Including:—*Plesiosaurus brachyspondylus*, Owen [1].
Plesiosaurus recentior, Meyer [2].
Plesiosaurus lævis, Owen [3].

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[1] Rep. Brit. Assoc. for 1839, p. 78 (1840).
[2] Palæologica, p. 112 (1832).
[3] Cat. Foss. Rept. Mus. R. Coll. Surgeons, p. 62 (1854).

Pliosaurus brachyspondylus, Seeley [1].
Pliosaurus nitidus, Phillips [2].
Pliosaurus simplex, Phillips [3].
Pliosaurus gamma, Phillips [4] (*ex* Owen).

The specimens from the Kimeridge Clay which have been described under the foregoing names are all evidently referable to immature individuals probably belonging for the most part either to *P. brachydirus* or *P. macromerus*. Their immaturity is shown by the extreme smoothness and the flatness of the terminal faces of the vertebræ, and the relative shortness of the ischia (fig. 44), of which the free borders were evidently covered with cartilage. The base of the neural canal of the vertebræ is also very clearly marked, and its posterior expansion very wide, owing to the incomplete development of the arch. Neither of the above-mentioned names, except those given by Phillips, were sufficiently defined to have a right to supersede the name *P. macromerus*.

R. 1243. Cast of the centrum of a late posterior cervical vertebra. The original was obtained, in association with thirty dorsals, from the Kimeridge Clay of Ely, Cambridgeshire, and is preserved in the Woodwardian Museum at Cambridge. It is noticed by Seeley in his 'Index to Aves &c. in Cambridge Museum,' p. 97 (No. *e*. 5), under the name of *P. brachyspondylus*; the associated dorsals being described on pp. 102, 103 of the same. The present specimen is remarkable that while on the right side there is only a single costal facet, on the left there are two such facets. The terminal faces are quite flat; and the broad posterior expansion of the base of the neural canal is well shown. The dimensions are:—length 0,038 (1·5 inches), height 0,071 (2·8 inches), width 0,805 (3·2 inches). The specimen closely accords with the type posterior cervical of *P. nitidus* figured by Phillips in his 'Geology of Oxford,' p. 360, fig. 156.

Made in the Museum, 1888.

31925. An entire anterior dorsal vertebra, together with the ribs, of a somewhat smaller individual; from the Kimeridge Clay of Shotover, Oxfordshire. Accords exactly with the dorsal figured by Phillips, p. 361, fig. 157, as one of the

[1] Index to Aves &c. in Cambridge Museum, p. 102 (1869).
[2] Geology of Oxford, p. 360 (1871).
[3] *Ibid.* p. 366.
[4] *Ibid.* p. 358.

types of *P. nitidus*. Length of centrum 0,046 (1·4 inches), height 0,065 (2·25 inches), width 0,071 (2·8 inches). The characters of the centrum are precisely similar to those of the next specimen. *Purchased. About* 1852.

33111. The neural arch of a dorsal vertebra; probably from Shotover. Although rather larger this specimen agrees precisely with the arch of the preceding specimen. The horizontal articular surfaces of the zygapophyses are well shown. *Purchased. About* 1852.

R. 1248. The slightly imperfect neural arch of a larger dorsal vertebra; probably from Ely. This specimen agrees in relative size with the centrum No. 20280 (*infrà*), and has the facets for the centrum antero-posteriorly elongated, *Purchased. About* 1852.

R. 1248 a. The imperfect neural arch of a lumbar (?) vertebra not improbably associated with the preceding. The transverse process has become lower and the facets for the centrum are transversely elongated. *Purchased. About* 1852.

46788. The neural arch of a small dorsal vertebra; from the Kimeridge Clay of Foxhangers near Devizes, Wiltshire. Probably belongs to the same individual as No. 46789 (*infrà*). *Cunnington Collection. Purchased*, 1875.

46788 a. A similar specimen belonging to the same individual. *Cunnington Collection.*

46481. The centrum of a dorsal vertebra; from Devizes. *Cunnington Collection.*

46789. The centrum of a small anterior dorsal vertebra; from Foxhangers. Length 0,031 (1·12 inches), height 0,053 (2·18 inches), width 0·058 (2·3 inches). *Cunnington Collection.*

46789 b. A very similar centrum; from Foxhangers. *Cunnington Collection.*

46789 c. The worn centrum of what is probably a pectoral vertebra, of the same relative size as the preceding; from Foxhangers. *Cunnington Collection.*

R. 254. The centrum of a later dorsal vertebra of rather larger size than that of No. 31925; from Shotover. *Egerton Collection. Purchased*, 1882.

R. 254 a. The centrum of a rather larger posterior dorsal vertebra; from Shotover. Length 0,061 (2·4 inches), height 0,074 (2·8 inches), width 0,080 (3·15 inches).

Egerton Collection.

31915. The crushed centrum of a very similar dorsal vertebra; from Shotover. *Purchased. About* 1852.

31918. The crushed centrum of a dorsal vertebra; from Shotover. *Purchased. About* 1852.

24684. The centrum of a smaller dorsal vertebra; from the Kimeridge Clay of Wootton-Bassett, Wiltshire.

Cunnington Collection. Purchased, 1849.

24684 a. The centrum of a dorsal vertebra; from Wootton-Bassett.

Cunnington Collection.

R. 1277. Three imperfect centra of anterior dorsal vertebræ; from the Kimeridge Clay of Kimeridge Bay, Dorsetshire.

Presented by J. C. Mansel-Pleydell, Esq., 1888.

41776 x. The centrum of an anterior dorsal vertebra agreeing very closely with that of No. 31925; from Weymouth.

Purchased, 1869.

41776 y. The centrum of what is apparently a lumbar vertebra; from Weymouth. *Purchased*, 1869.

20280. The centrum of a posterior dorsal vertebra; from the Kimeridge Clay of Ely. Length 0,063 (2·5 inches), height 0,090 (3·5 inches), width 0·095 (3·75 inches). Although of somewhat larger dimensions this specimen accords well with the dorsal figured by Phillips, *op. cit.* p. 361, fig. 157, exhibiting the same spoon-shaped base of the neural canal, and the flattened terminal faces, which are, however, more nearly circular.

Purchased, 1846.

41802. The centra of four dorsal and three caudal vertebræ, apparently associated; from Ely. The dorsals agree with the preceding specimen; the caudals, of which the third has chevron-facets on its posterior border, have the same great posterior expansion of the base of the neural canal.

Purchased, 1869.

31901. The centrum of a dorsal vertebra, agreeing in size with No. 20280; from Shotover. *Purchased. About* 1852.

46484. The centrum of a vertebra probably belonging to the lumbar series; from Foxhangers. The characteristic form of the base of the neural canal is well shown.
Cunnington Collection. Purchased, 1875.

46484 a. A rather larger centrum of similar type; from Foxhangers. *Cunnington Collection.*

46184 b. The centrum of an anterior caudal vertebra; from Foxhangers. Closely resembles the anterior caudal of *P. nitidus* figured by Phillips, p. 361. *Cunnington Collection.*

31933. (*Fig.*) A left scapula, most probably associated with one of the above-mentioned vertebræ; from Shotover. This and the following specimen are noticed by Hulke in the 'Proc. Geol. Soc.' 1883, p. 59, as if they belonged to a single individual, under the name of *P. planus*; the present specimen is figured in woodcut, fig. 36 (p. 122). This bone agrees in relative size with several of the above vertebræ, and also has the same smooth and fine-grained external surface, indicative of immaturity. In contour it resembles the scapula of *Peloneustes*. The ventral plate is but little expanded, and probably united by a cartilaginous symphysis with its fellow. The length from the glenoidal cavity to the middle of the ventral symphysis is 0,185 (7·25 inches); and the antero-posterior diameter of the ventral plate 0,098 (3·85 inches).
Purchased. About 1852.

31934. A rather smaller scapula of the opposite side; from Shotover. *Purchased. About* 1852.

R. 1249. (*Fig.*) The right pubis; from Ely. This bone is nearly square, its diameter being 0,267 (10·5 inches). Figured in the woodcut on the next page. *No history.*

31803. An imperfect right pubis; from Shotover. Not improbably associated with one of the above-mentioned vertebræ, and agreeing closely with the preceding.
Purchased. About 1852.

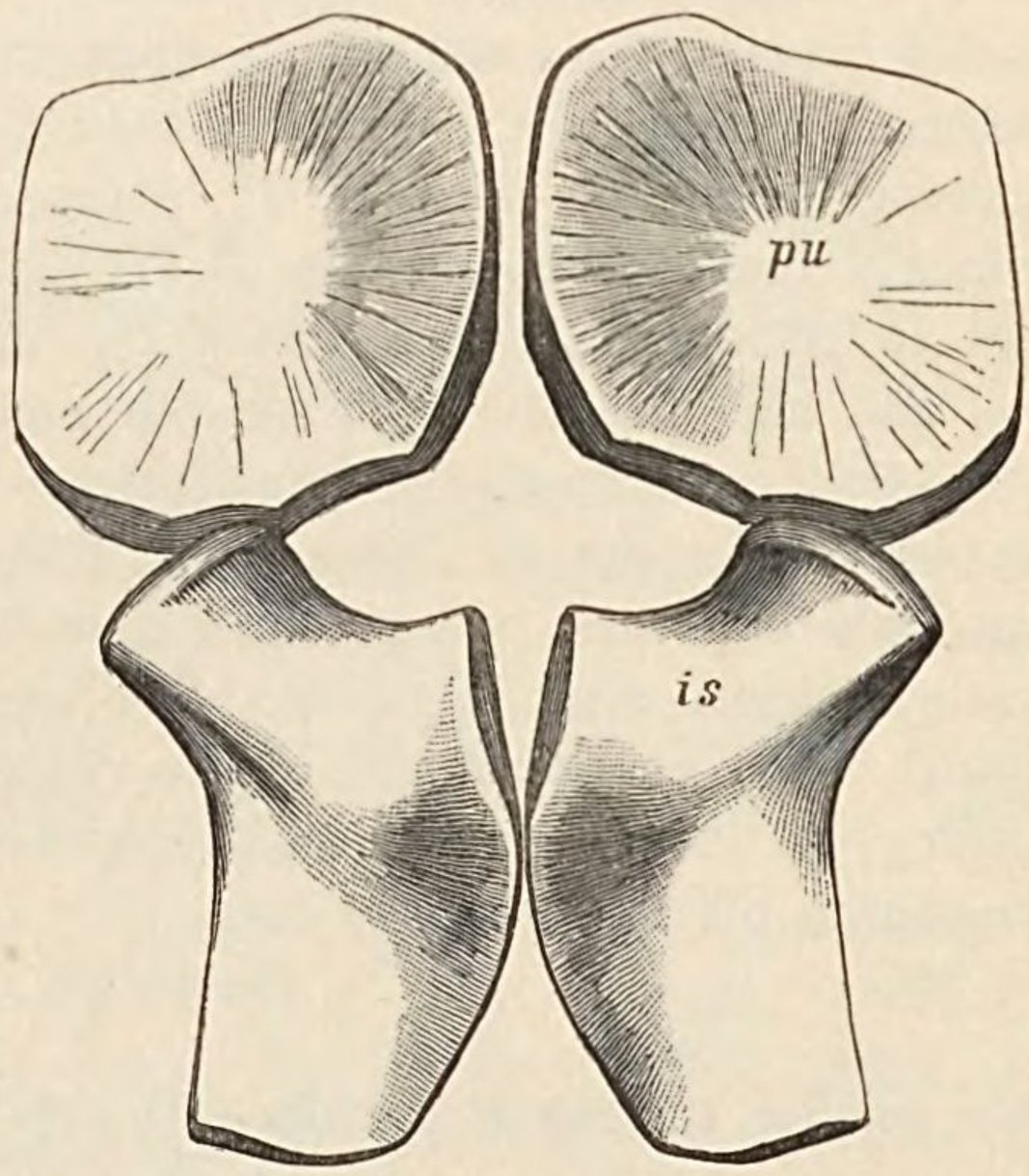
40177. A smaller right pubis, with portions of the middle restored; from the Kimeridge Clay, locality unknown.
Purchased, 1866

31799. The left ischium; from Shotover. This specimen is repre-
(*Fig.*) sented in fig. 44, and was probably associated with No. 31803; it closely resembles the ischium of the opposite side from the same locality, figured in Phillips's 'Geology of Oxford,' p. 351. The diameter from the anterior extremity of the symphysis to the postero-external angle is 0,312 (12·3 inches). *Purchased. About* 1852.

46468. A similar right ischium; from Foxhangers.
Cunnington Collection.

46468 a. A slightly smaller right ischium; from Foxhangers.
Cunnington Collection.

Fig. 44.



Pliosaurus, sp.—Ventral aspect of the pelvic girdle of an immature individual; from the Kimeridge Clay. *pu*, pubis; *is*, ischium. About $\frac{1}{10}$ nat. size.

46478. A left humerus or femur; from Devizes. Length 0,422 (16·6 inches), diameter of distal extremity 0,145 (7·7 inches), these dimensions being almost identical with those of the type of the so-called *P. simplex*. *Cunnington Collection.*

31788. A similar specimen, with the postaxial border imperfect distally; from Shotover. *Purchased. About* 1852.

47127. A somewhat smaller specimen of the right side, with both borders imperfect distally; from Ely. In its smooth texture this bone agrees very closely with the dorsal vertebra No. 20280. *Sharp Collection.*

44602. An entire right humerus or femur, agreeing very closely with the preceding; from Swindon.

Presented by the Directors of the Swindon Brick and Tile Company, 1873.

Pliosaurus ferox (Sauvage [1]).

Syn. *Liopleurodon ferox*, Sauvage [2].
Polyptychodon ferox, Sauvage [3].
? *Pliosaurus pachydirus*, Seeley [4].
? *Thaumatosaurus mosquensis*, Kiprijanoff [5].

Usually about equal in size to the type species. Teeth with the carinæ imperfectly developed and approximated, and, in some cases, ridges developed on the intercarinal space. Vertebræ of the general type of those of *P. macromerus*. A mandible from the Oxford Clay of Peterborough in the Collection of Mr. Leeds has 28 teeth and a length of 3 ft. 6 inches.

This species (the type of *Liopleurodon*) was founded upon teeth from the Oxford Clay of Boulogne. Similar teeth occur in the same formation in England, and it is probable that the cervical vertebræ from the Oxford Clay to which the name *P. pachydirus* was applied are specifically the same. The same remark will apply to the Russian *Thaumatosaurus mosquensis* of the Oxfordian.

This species was probably the ancestor of *P. macromerus*.

Hab. Europe (France, England, and (?) Russia).

R. 1279. A tooth, wanting the greater part of the root; from the Oxford Clay (Middle Jurassic) near Peterborough, Northamptonshire. This specimen, although of rather smaller dimensions, agrees precisely with the type tooth figured by Sauvage in the 'Bull. Soc. Géol. France,' sér. 3, vol. i. pl. vii. fig. 1. There is a small and distinct intercarinal space, and the ridges on the concave surface are approximated. It would accord well with the large teeth figured by Kiprijanoff in the 'Mém. Ac. Imp. St. Pétersbourg,' vol. xxxi. art. 6, pl. xii., as *Thaumatosaurus mosquensis*.

Presented by A. N. Leeds, Esq., 1888.

R. 1279 a. Cast of the crown and upper part of the root of a much larger tooth. The original was obtained from the Oxford

[1] Bull. Soc. Géol. France, sér. 3, vol. i. p. 378 (1873).—*Liopleurodon*.
[2] *Loc. cit.*
[3] Bull. Soc. Géol. France, sér, 3, vol. viii. p. 544 (1880).
[4] Index to Aves &c. in Cambridge Museum, p. 118 (1869).—Undescribed.
[5] Mém. Ac. Imp. St. Pétersbourg, vol. xxxi. art. 6, p. 27 (1883).

Clay near Peterborough, and is in the Collection of A. N. Leeds, Esq. On the concave side of the crown there are very few ridges. The height of the crown is 0,100 (3·9 inches), and the greatest transverse diameter 0,063 (2·1 inches). *Made in the Museum*, 1888.

39787. The imperfect crown of a tooth very similar to No. R. 1279; from the Oxford Clay of Weymouth, Dorsetshire. The summit of the crown is wanting, but a distinct intercarinal space can be seen on the concave surface. The ridges on the lateral (fig. 45) and concave surfaces are placed further apart than in the preceding specimen. This example also accords with the teeth figured by Kiprijanoff. *Purchased.*

Fig. 45.

Pliosaurus ferox.—Part of the lateral surface of the crown of a tooth; from the Oxford Clay of Weymouth. $\frac{1}{1}$.

32648. A small posterior tooth; from the Oxford Clay of Vaches-Noires (Calvados), France. In this specimen the ridges continue quite round the crown. It is indistinguishable from the two teeth figured by Kiprijanof, *op. cit.* pl. xiii. fig. 1. *Tesson Collection. Purchased*, 1857.

24683. The crown of a smaller tooth of similar type; from the Oxford Clay of Christian Malford, Wiltshire.

Purchased, 1850.

46006. The imperfect crown of a very large tooth; probably from the Oxford Clay of Dorsetshire. The diameter of the fractured basal extremity is 0,051, and there is no trace of an intercarinal space. *Purchased*, 1876.

47429. The centrum of a somewhat crushed late cervical vertebra, probably belonging to this species; from the Oxford Clay of Whittlesea, near Peterborough. Length 0,038 (1·5 inches), height 0,085 (3·35 inches), width 0,110 (4·35 inches). The costal facets are still divided, but the upper one is connected by a ridge with the facet for the arch. In the rough nature of the free surface this specimen

agrees with the cervicals in the Cambridge Museum to which the name *P. pachydirus* has been applied.

Purchased, 1876.

The following form may be identical with one of the preceding.

Pliosaurus (*Polyptychodon*) *archiaci*, Deslongchamps[1]; Kimeridgian, Boulogne.

Specifically undetermined specimens.

R. 38. The imperfect anterior extremity of a cranium; from the Kimeridge Clay of Osmington, near Weymouth, Dorsetshire. This specimen shows the broken bases of both the large and small teeth, and also the summit of the crown of a germ-tooth. It very probably belongs to *P. brachydirus*. *Purchased*, 1880

39225. Fragment of a mandible; from the Kimeridge Clay of Stukeley, Hampshire. This specimen comprises part of both rami immediately behind the symphysis; the right one showing nine alveoli. *Purchased*, 1865.

R. 484. The centrum of a dorsal vertebra; from the Jurassic of Higham-Ferrers, Northamptonshire. In contour this specimen resembles the dorsals of *P. macromerus*, but its dimensions are smaller than those of adult examples.

Presented by T. I. Starling, Esq.

41862. The proximal portion of a large rib; from the Kimeridge Clay of Weymouth. *Purchased*, 1869.

R. 736. Part of a rib; from the Kimeridge Clay of Kimeridge Bay, Dorsetshire.

Presented by J. C. Mansel-Pleydell, Esq., 1886.

GENERICALLY UNDETERMINED SPECIMENS.

Of the following limb-bones some may belong to Pliosaurus *and others to* Cimoliosaurus.

R. 1306. Cast of a small right femur. The original was obtained from the Kimeridge Clay of Shotover, near Oxford, and was formerly in the Collection of the Earl of Enniskillen. The cast is figured by Phillips in his 'Geology of Oxford,' p. 363, as *Pliosaurus grandis*. The dimensions are:—length 0,314 (12·4 inches), width at distal extremity

[1] In Lennier's 'Etudes géologiques et paléontologiques sur l'Embrasure de la Seine,' p. 30 (1870).

0,147 (5·8 inches); these being much smaller than those of either of the three propodials described by Owen in the 'Rep. Brit. Assoc.' for 1839, p. 83, under the name of *Plesiosaurus grandis*. There is a rugosity on the ventral surface below the head. This specimen not improbably belongs to *Cimoliosaurus*.

Enniskillen Collection. Purchased, 1882.

31785. A large left humerus; from the Kimeridge Clay of Shotover. Length 0,511 (20·6 inches).

Purchased. About 1852.

31791. A left humerus, agreeing in size with the preceding; from Shotover. *Purchased.*

40107 c. A rather smaller left humerus; from the Kimeridge Clay of Kimeridge Bay, Dorsetshire. From its general resemblance to smaller humeri from the Oxford Clay of the type of those of *Cimoliosaurus plicatus*, it is not improbable that this specimen may belong to *C. truncatus*.

Presented by J. C. Mansel-Pleydell, Esq., 1866.

44601. The distal extremity of a humerus or femur, agreeing in size with the preceding; from the Kimeridge Clay of Swindon, Wiltshire.

Presented by the Directors of the Swindon Brick and Tile Company, 1873.

31790. An imperfect propodial bone of a large form; from Shotover. *Purchased. About* 1852.

31792. A rather smaller and less imperfect specimen; from Shotover. *Purchased.*

42497. A nearly entire propodial bone of large size; from Kimeridge Bay. *Presented by J. C. Mansel-Pleydell, Esq.*, 1870.

42497 a. A similar and apparently associated specimen.

Presented by J. C. Mansel-Pleydell, Esq., 1870.

31820. A smaller left propodial bone; from Shotover.

Purchased. About 1852.

46477. A right propodial bone of nearly the same dimensions; from the Kimeridge Clay of Devizes, Wiltshire.

Cunnington Collection. Purchased, 1875.

31797. A propodial bone (? humerus), agreeing nearly in size with the preceding; from Shotover. *Purchased. About* 1852.

31789. A comparatively small propodial bone; from Shotover.
Purchased. About 1852.

R. 1256. A smaller propodial bone; from the Kimeridge Clay of Wootton-Bassett, Wiltshire. *No history.*

R. 1257. A still smaller specimen; from the Kimeridge Clay, locality unknown. *No history.*

46476. A comparatively small left femur, imperfect distally; from Devizes. *Cunnington Collection.*

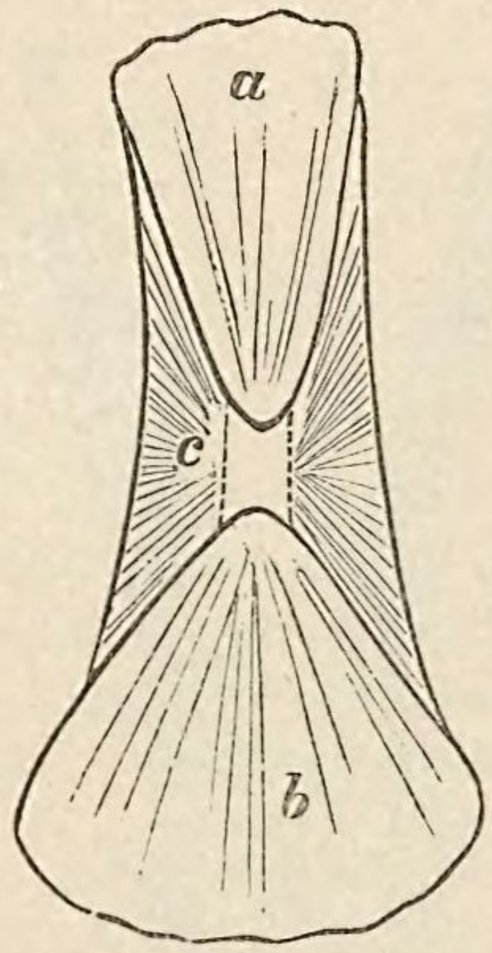
47415. A very small propodial bone; (?) from the Kimeridge Clay, locality unknown. *Sharp Collection.*

31786. A comparatively large propodial bone; from Shotover. Length 0,437 (17·2 inches), diameter of distal extremity 0,193 (7·6 inches). *Purchased. About* 1852.

33117. An epipodial or phalangeal bone of a large form; from the Kimeridge Clay of Honfleur. *Purchased.*

24803. Two somewhat smaller specimens; from the Kimeridge Clay of Wootton-Bassett, Wiltshire.
Cunnington Collection. Purchased, 1849.

Fig. 46.



Longitudinal section of a propodial bone of a Sauropterygian; from the Kimeridge Clay of Ely. $\frac{1}{6}$. *a*, proximal, *b*, distal epiphysis; *c*, shaft.

46792. Two still smaller specimens; from the Kimeridge Clay of Devizes, Wiltshire. *Cunnington Collection.*

R. 400. Two phalangeals; from the Oxford Clay of Weymouth, Dorsetshire. *Presented by C. Westendarp, Esq.*, 1884.

R. 1381. (*Fig.*) One longitudinal half of the humerus or femur of a medium-sized form, with the inner surface cut and polished; from the Kimeridge Clay of Ely. This specimen is figured in the woodcut on the preceding page, and shows the two epiphyses almost meeting in the middle of the shaft.

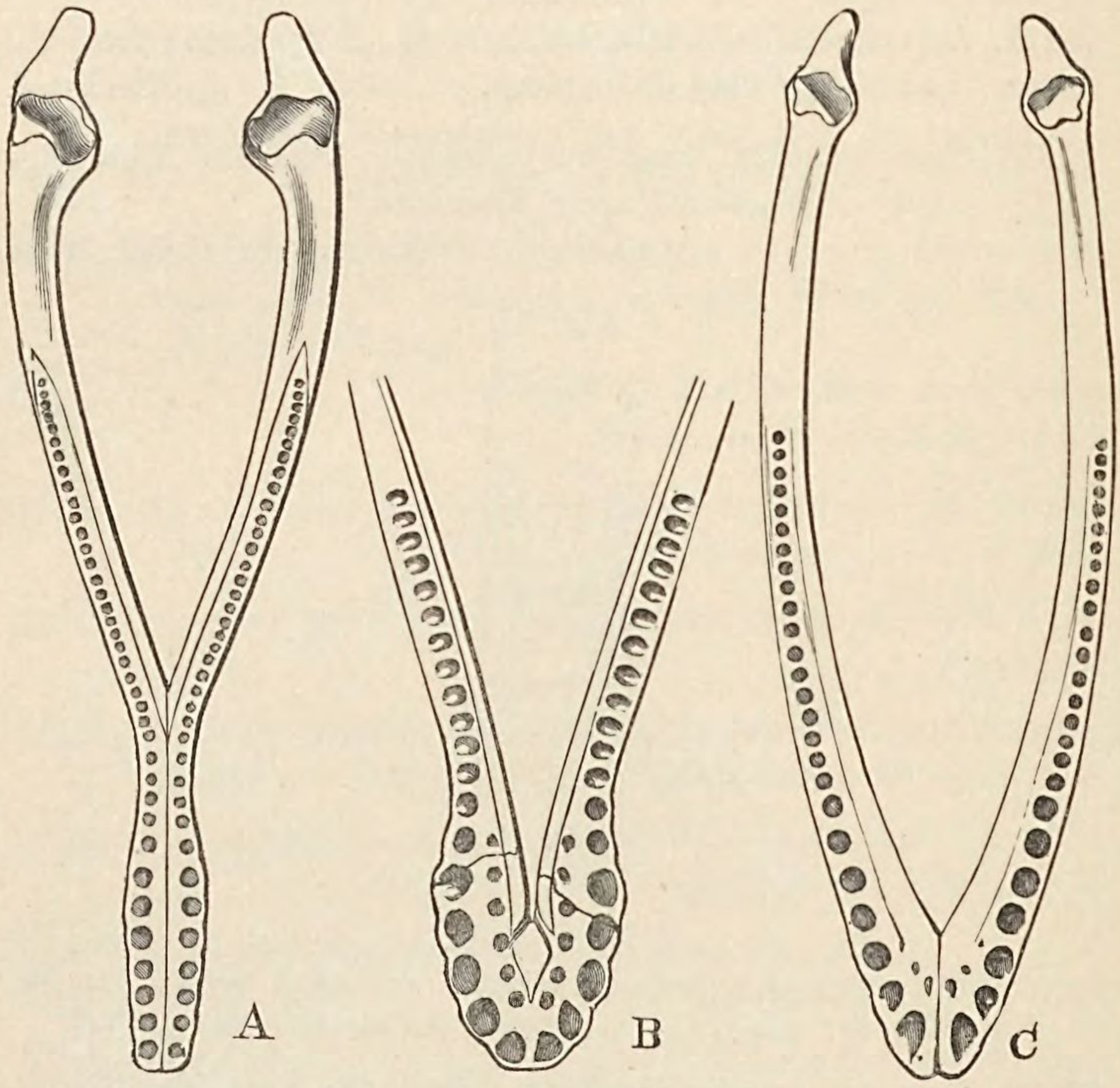
No history.

R. 1381 a. The proximal half of a larger humerus or femur, longitudinally bisected; from the Kimeridge Clay of Ely. The contour of the proximal epiphysis is well displayed.

No history.

46912. The proximal portion of a still larger humerus or femur, longitudinally bisected; from Shotover. The whole of the proximal epiphysis is displayed, of which the terminal

Fig. 47.



Sauropterygian mandibles.—A. *Peloneustes philarchus*; from the Oxford Clay. $\frac{1}{8}$. B. *Thaumatosaurus indicus*; from the Upper Jurassic of India. $\frac{1}{7}$. C. *Plesiosaurus dolichodirus*; from the Lower Lias. $\frac{2}{5}$. (From the 'Rec. Geol. Surv. Ind.')

extremity appears to have been separated by a small vacuity from that of the distal epiphysis. *No history.*

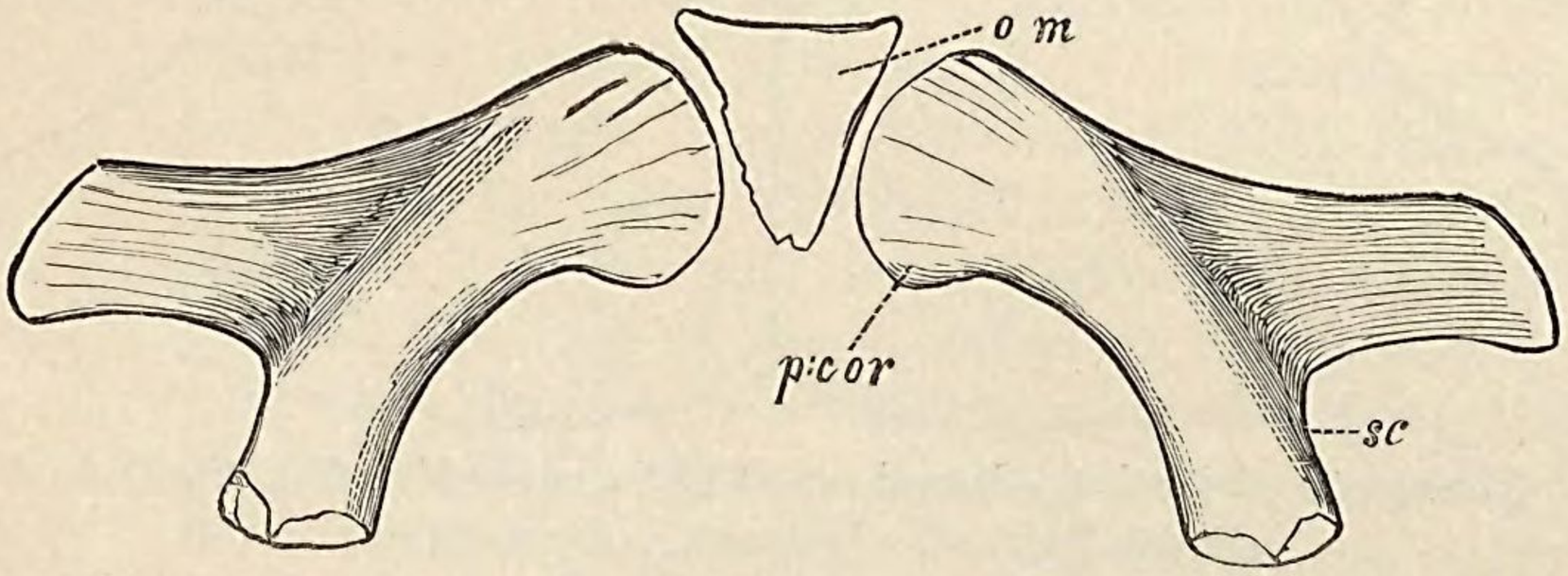
42097. One lateral half of a humerus or femur, with the inner surface cut; from the Neocomian bone-bed of Potton, Bedfordshire. The extremity of one epiphysis is entire and detached from the shaft, while a section is shown of that at the opposite end. *Purchased*, 1870.

42098. A small imperfect femur, with the proximal epiphysis detached and lying loose in the cup of the shaft; from Potton. *Purchased*, 1870.

Genus **PELONEUSTES,** Lydekker [1].

Skull and teeth of the general type of *Pliosaurus*, but the mandible (fig. 47, A) with a longer symphysis, which includes more than a dozen teeth. Neck short, with the anterior vertebræ relatively short. Vertebræ with the arches and cervical ribs articulating with the centra by suture, of which traces always persist. Cervicals (fig. 55) with very short centra, without distinct hæmal ridge, and

Fig. 48.



Peloneustes philarchus.—Ventral aspect of the anterior portion of the pectoral girdle; from the Oxford Clay of Peterborough. Reduced. *om*, omosternum; *sc*, scapula; *p.cor*, ventral(precoracoidal) plate of do. The longitudinal ridge between the ventral and dorsal surface is not sufficiently indicated.

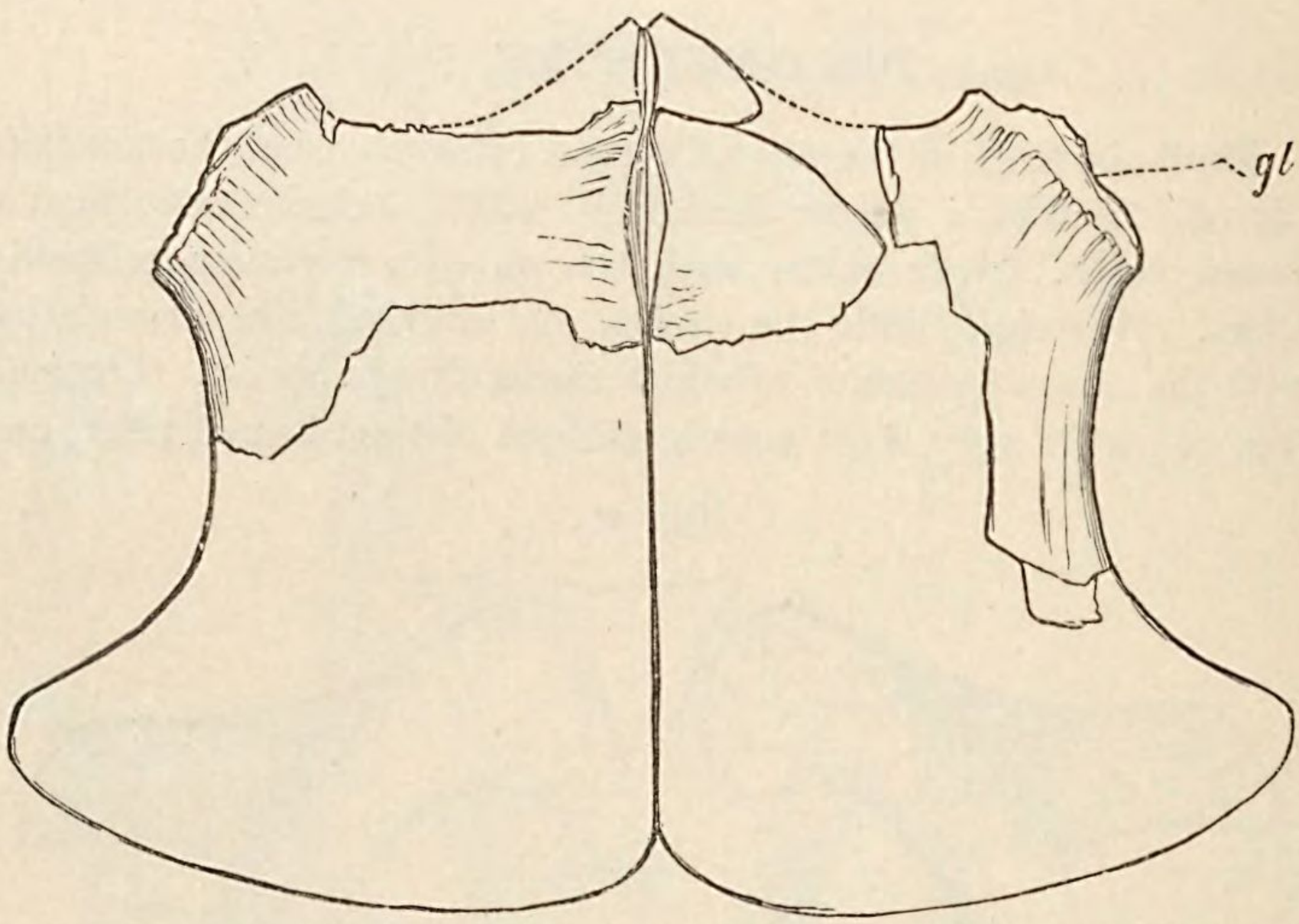
in the anterior part of the series with prominent double costal facets, and the external surface smooth; their terminal faces only slightly cupped, transversely ellipsoidal, and somewhat angulated. Dorsals with longer centra, having nearly flat terminal faces, and forward overhang of upper part. Pectoral girdle of the general type of *Pliosaurus*, with a small triangular omosternum between the ventral plates of the scapulæ (fig. 48), which have a strong ridge

[1] Quart. Journ. Geol. Soc. vol. xlv. p. 49 (1889).

dividing the ventral from the dorsal portion, and are thus more of the type of *Thaumatosaurus*. Pelvis (figs. 53, 54) like that of *Pliosaurus*, the pubis and ischium uniting to form an obturator foramen. Relative lengths of humerus and femur unknown. Humerus articulating distally with only the radius and ulna, which are relatively short, and separated only by a small interval (fig. 52); ulna and fibula subreniform, the former being considerably the larger of the two.

This genus may have been directly derived from the Longirostrine group of *Plesiosaurus*.

Fig. 49.



Peloneustes philarchus.—Dorsal aspect of the coracoids; from the Oxford Clay of Bedford. Reduced. *gl*, glenoid cavity.
(*This and the preceding figure from the 'Quart. Journ. Geol. Soc.'*)

Peloneustes æqualis (Phillips[1]).

Syn. *Pliosaurus æqualis*, Phillips[2].
Pliosaurus sterrodirus, Seeley[3].

Imperfectly known. Cervical vertebræ with the neural canal sunk into the centrum, and the "pectorals" with distinctly concave terminal faces. Larger than typical examples of the next species.

This species was founded upon a femur (fig. 50) from the Kimeridge Clay of Oxfordshire, which so closely resembles the corresponding bone of *P. philarchus* as to indicate its generic identity; the

[1] Geology of Oxford, p. 365 (1871).—*Plesiosaurus*. [2] *Loc. cit.*
[3] Index to Aves &c. in Cambridge Museum, p. 98 (1869).—No description.

length of this specimen is 0,572 (23 inches). The undermentioned vertebræ agree in relative size with this femur, and in generic characters with those of the type species.

Hab. Europe (England).

R. 1413. Cast of an imperfect cervical vertebra, probably from the middle region of the neck. The original was obtained from the Kimeridge Clay of Ely, Cambridgeshire, and is preserved in the Woodwardian Museum, Cambridge (No. $\frac{85}{d.6}$). It is referred to on p. 99 of Seeley's 'Index to Aves &c. in Cambridge Museum' as one of the types of *Plesiosaurus sterrodirus*. The specimen has lost nearly the whole of the neural arch, the whole of the left, and the distal portion of the right rib. The dimensions of the centrum are:—length 0,038 (1·48 inches), width 0,078 (3·06 inches), height 0,057 (2·3 inches); these according fairly well in relative size with the type femur. The terminal faces are nearly flat; and the rib is anchylosed to the centrum, although the line of suture is visible. In an associated "pectoral" vertebra in the Cambridge Museum (No. $\frac{85}{d.9}$) the centrum is relatively longer, with more concave terminal faces; its dimensions being length 0,048 (1·87 inches), width 0,082 (3·21 inches), height 0,061 (2·4 inches). In general characters this specimen agrees with the figured "pectoral" or lumbar of *P. philarchus* (No. R. 1253), with the exception that, as in the cervicals, the base of the neural canal is sunk into the centrum, which has somewhat more concave faces; the dimensions of the centrum of that specimen are:—length 0,040 (1·55 inches), width 0,072 (2·85 inches), height 0,058 (2·25 inches). *Made in the Museum*, 1888.

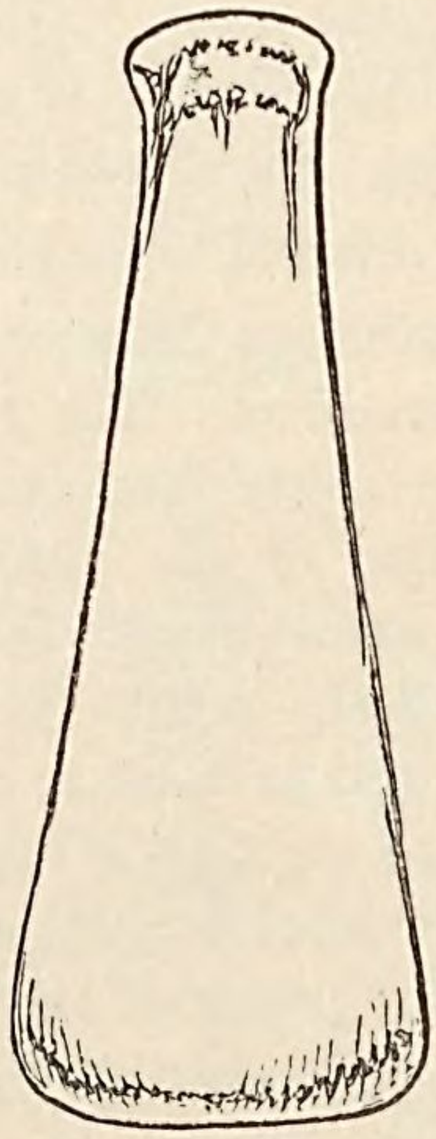
47325. (*Fig.*) The right (?) ischium; from the Kimeridge Clay (Upper Jurassic) of Swindon, Wiltshire. This specimen (woodcut fig. 54) agrees precisely with the ischia of *P. philarchus* in the collection of A. N. Leeds, Esq., of Eyebury, Peterborough. It dimensions are:—length 0,450 (16 inches), width at proximal extremity 0,261 (10·5 inches). It is noticed by the writer in the 'Quart. Journ. Geol. Soc.' vol. xlv. p. 52.

Presented by the Directors of the Swindon Brick and Tile Company, 1876.

R. 1255. A left femur probably referable to this species; from the Kimeridge Clay of Broughton-Gifford, Wiltshire. The

resemblance of this specimen to the larger type femur (fig. 50), and also to the corresponding bone of the limb of *P. philarchus* No. 47410 (p. 158), leaves little doubt of the generic identity of the two. *No history.*

Fig. 50.



Peloneustes æqualis.—A femur; from the Kimeridge Clay of Swindon. $\frac{1}{10}$. (*After Phillips.*)

Peloneustes philarchus (Seeley [1]).

Syn. *Plesiosaurus philarchus*, Seeley [2].
Thaumatosaurus philarchus, Lydekker [3].

The type species. Premaxilla with five teeth, and 37 or 38 in the mandible, of which at least 14 are in the symphysis; some 20 or 21 cervical vertebræ, in which the neural canal is not sunk into the centrum. The mandible and paddle from the Oxford Clay, figured on pp. 317, 318 of Phillips's 'Geology of Oxford,' indicate a larger form allied to the present; but the propodial bone of the paddle belongs to a totally different and much smaller Sauropterygian.

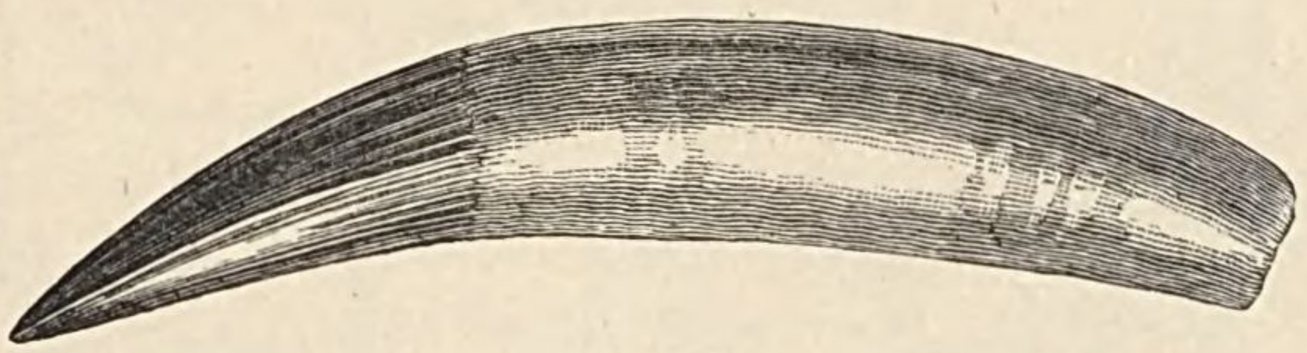
This species was founded upon an imperfect skeleton in the Cambridge Museum, in which there are some 18 or 19 cervical vertebræ; specimens in the collection of A. N. Leeds, Esq., of Eyebury, Peterborough, show the presence of 20 or 21 cervicals.

Hab. Europe (England).

[1] Index to Aves &c. in Cambridge Museum, p. 139 (1869).—*Plesiosaurus.*
[2] *Loc. cit.* [3] Geol. Mag. dec. 3, vol. v. p. 353 (1888).

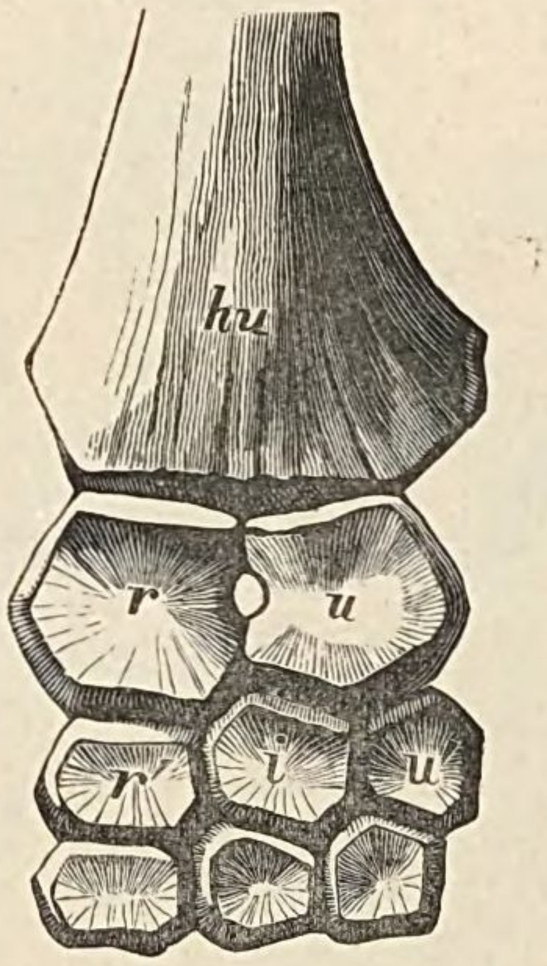
R. 1253. (*Fig.*) A considerable portion of the skeleton; from the Oxford Clay of Kempston, near Bedford. This specimen is described, with figures of several portions, by the present writer in the 'Quart. Journ. Geol. Soc.' vol. xlv. pp. 48–56, pl. ii., woodcuts 4–9. The bones are in most cases crushed. The specimens comprise six upper teeth; the nearly entire mandible; a number of vertebral centra, mostly from the dorsal, pectoral or lumbar, and caudal

Fig. 51.



Peloneustes philarchus.—An upper tooth; from the Oxford Clay of Bedford. $\frac{1}{1}$.

Fig. 52.

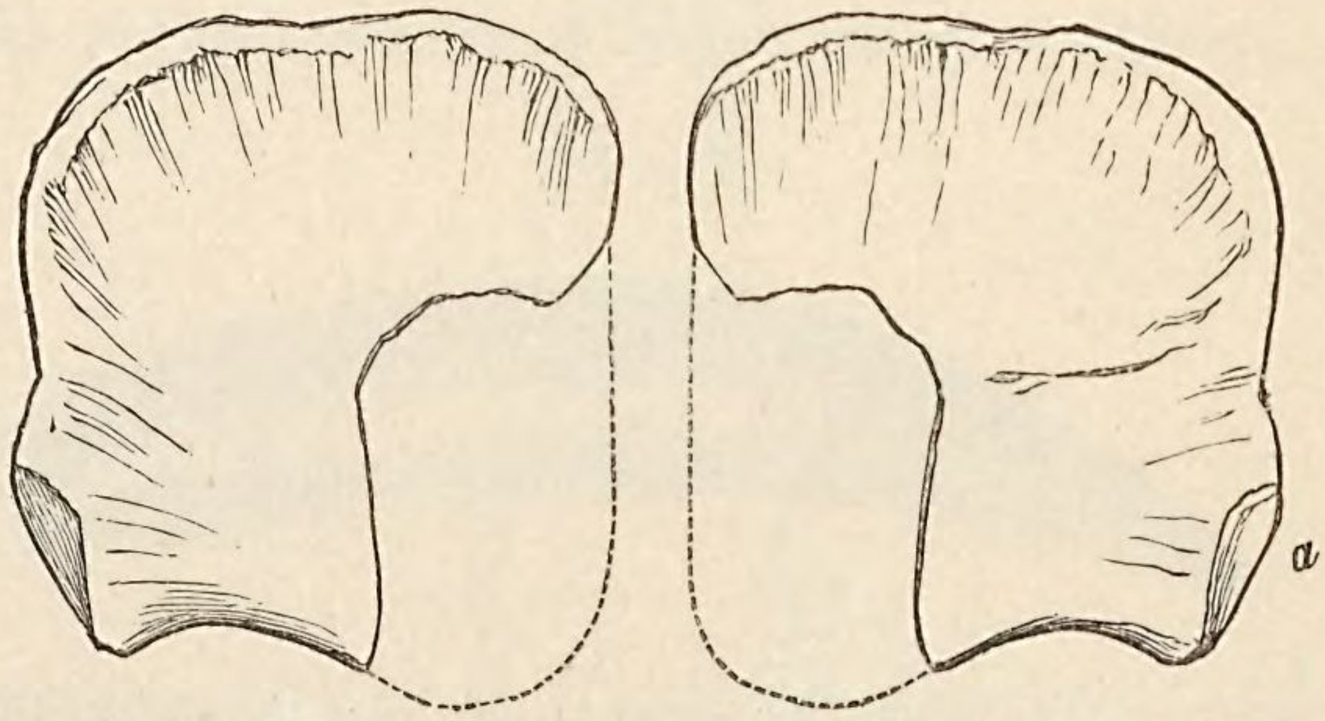


Peloneustes philarchus.—Part of pectoral limb; from the Oxford Clay of Bedford. About $\frac{1}{6}$. *hu*, humerus; *r*, radius; *u*, ulna; *r'*, radiale; *i*, intermedium; *u'*, ulnare.

regions; portions of ribs; a considerable portion of the pectoral and pelvic girdles; portions of the pectoral limbs; and the nearly entire pelvic limbs. The plate in the memoir cited gives figures of the mandible, and of a pectoral or lumbar and caudal vertebra; while the woodcuts (reproduced in figs. 48, 49, 51, 53, 54) show a tooth,

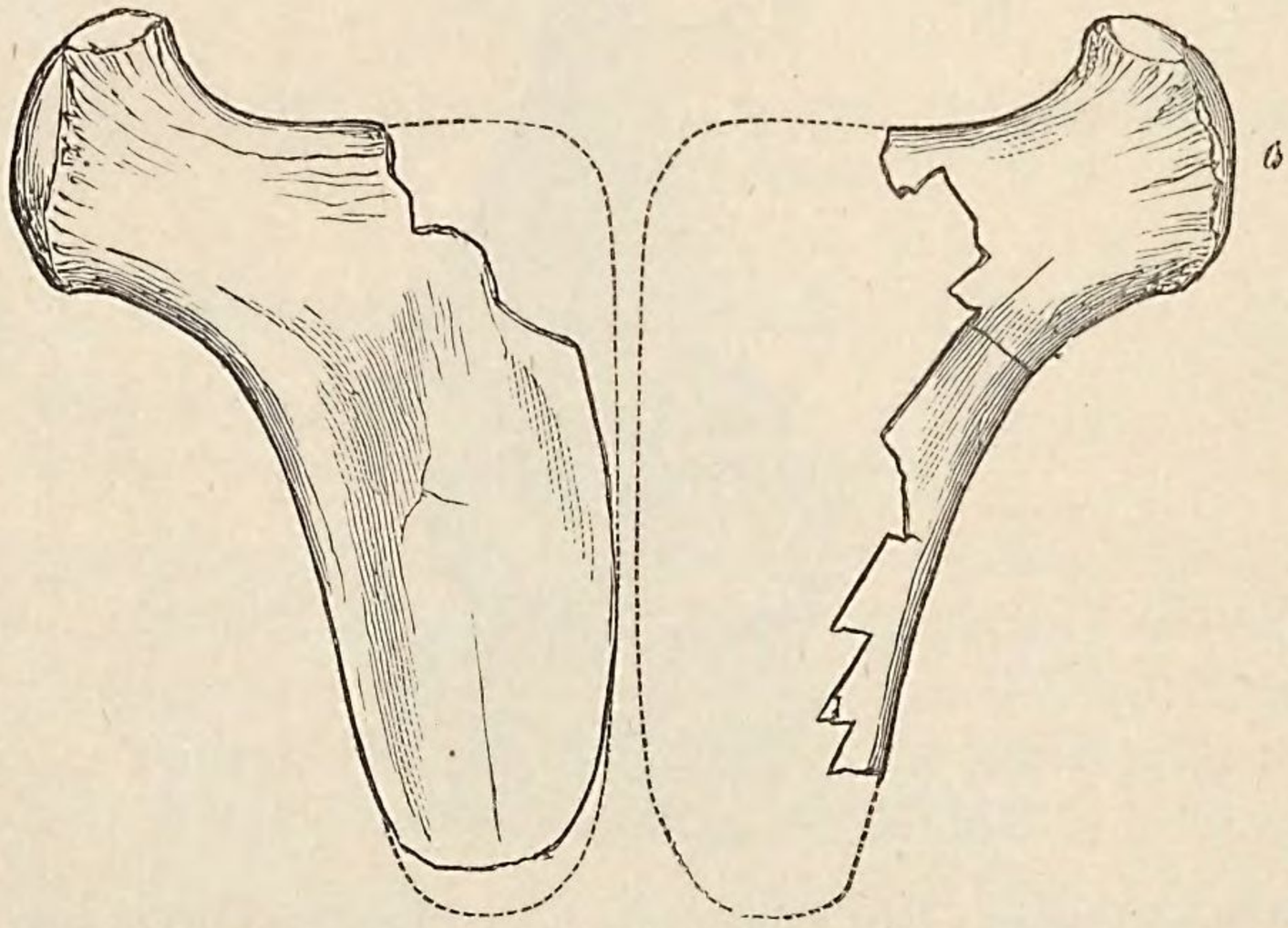
the pectoral and pelvic girdles, and a portion of the pelvic limb. The scapular region of the pectoral girdle shown in fig. 48 is drawn from a specimen in the possession of A. N. Leeds, Esq., of Eyebury near Peterborough. The upper teeth are in beautiful preservation. Specimens in

Fig. 53.



Peloneustes philarchus.— The pubes of No. R. 1253. Reduced.
a, acetabular facet.

Fig. 54.



Peloneustes philarchus and æqualis.—The ischia. The right side of the figure is from No. R. 1253; and the left side from No. 47325 (p. 153) of *P. æqualis*. *a*, acetabular facet. The median process for junction with the pubes is not indicated.

(*This and the preceding figure are from the 'Quart. Journ. Geol. Soc.'*)

Mr. Leeds's collection show that the ischia and pubes meet to enclose an obturator foramen, as in *Plesiosaurus*. The dimensions of the ulna (fig. 52) are: length 0,094 (3·7 inches), width 0,091 (3·6 inches); and those of the

fibula: length 0,076 (3·0 inches), width 0,079 (3·1 inches); the homology of these bones being determined from comparison with the skeleton of *Plesiosaurus rostratus*.

Presented by F. W. Crick, Esq., 1888.

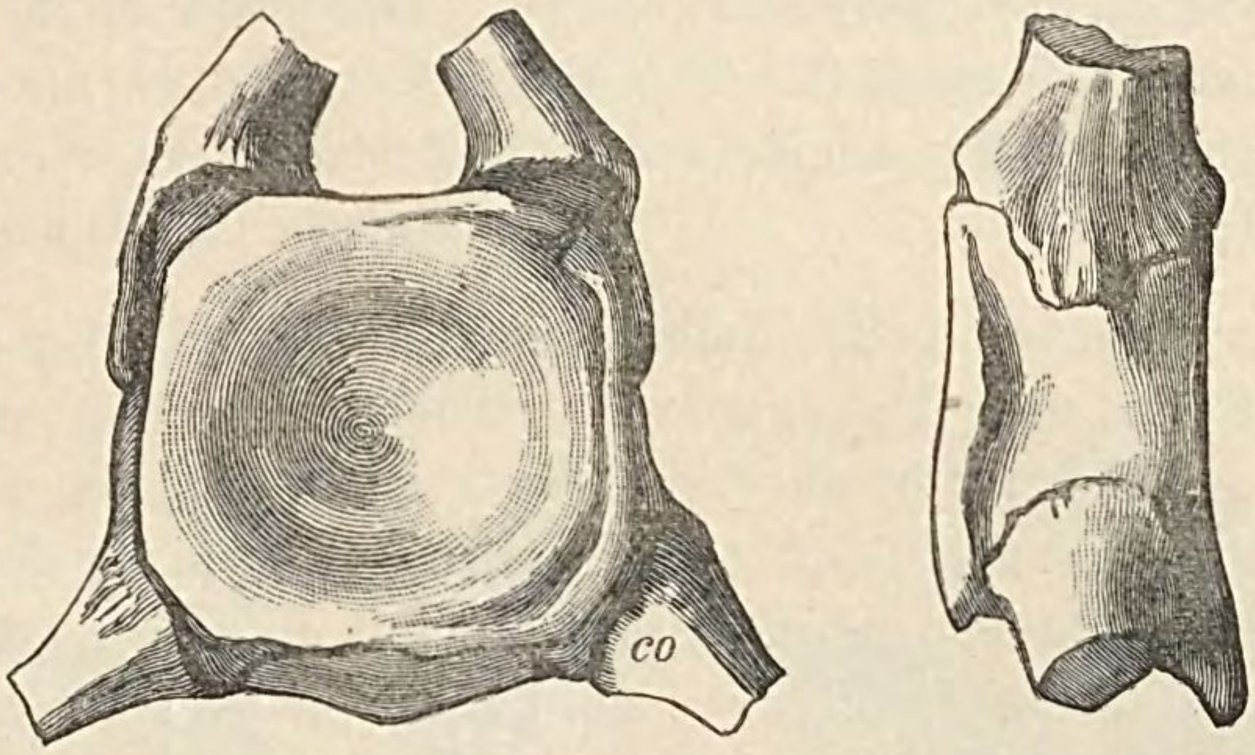
47411. (*Fig.*) The entire mandible; from the Oxford Clay of Peterborough, Northamptonshire. The teeth are wanting; but one or two germs are seen in the alveoli. This specimen (woodcut fig. 47, A) is noticed by the writer, Quart. Journ. Geol. Soc. vol. xlv. p. 49, and also in the 'Rec. Geol. Surv. Ind.' vol. xxii. p. 50. There are seven enlarged dental alveoli at the anterior extremity of the symphysis.

Sharp Collection. Purchased, 1876.

46354. A tooth, in matrix; from the Oxford Clay of Christian-Malford, Wiltshire. This specimen cannot be distinguished from the smallest upper tooth of No. R. 1253.

Cunnington Collection. Purchased, 1875.

Fig. 55.



Peloneustes philarchus.—Posterior and right lateral aspects of an imperfect cervical vertebra; from the Oxford Clay of Peterborough. *co*, rib. $\frac{1}{2}$.

R. 1254. Cast of the centrum and base of the arch of a cervical vertebra. The original (fig. 55) belongs to the type skeleton, which was obtained from the Oxford Clay of Peterborough, and is preserved in the Woodwardian Museum at Cambridge. It is described by Seeley in his 'Index to Aves &c. in the Cambridge Museum,' p. 139, and belongs to an adult individual. The ribs are anchylosed to the centrum, but show an imperfect division into two heads. The posterior face has been somewhat crushed in, and its contour is probably altered by pressure. In profile there is a forward overhang of the upper part of the centrum, and there is a descending pro-

jection of the anterior border of the inferior surface, as in some of the later cervicals of *Pliosaurus macromerus*. The dimensions are:—length 0,034 (1·35 inches), height 0,052 (2·05 inches), width 0,055 (2·18 inches).

Made in the Museum, 1888.

R. 1414. Cast of the centrum of a cervical vertebra of an immature individual. The original belongs to a skeleton in the collection of A. N. Leeds, Esq., which was obtained from the Oxford Clay near Peterborough. The specimen is somewhat crushed, but the double costal facets are very distinct. *Made in the Museum*, 1888.

R. 1414 a. Cast of the centrum of a larger cervical vertebra of an immature individual. The original belongs to a second skeleton in the above collection, which was obtained from the same deposit. The dimensions are:—length 0,033 (1·3 inches), height 0,048 (1·9 inches), width 0,056 (2·2 inches). The double costal facets are distinct, and the forward projection of the lower border of the anterior face well-marked. The general characters are very like those of the larger cervical of *P. æqualis*, No. R. 1413 (p. 153). *Made in the Museum*, 1888.

47410. An imperfect pelvic limb; from the Oxford Clay of Whittlesea, near Peterborough. The femur, tibia, and fibula, and the greater number of the tarsal and phalangeal bones are preserved; but the arrangement of many of them in the plaster in which they are set is incorrect. The tibia and fibula closely resemble those of No. R. 1253, the former being antero-posteriorly elongated. The femur is indistinguishable in contour from the type femur of *P. æqualis* (fig. 50), and the fibula, although slightly larger, corresponds closely with the corresponding bone of No. R. 1253. *Sharp Collection.*

Genus **THAUMATOSAURUS,** Meyer [1].

Syn. *Rhomaleosaurus*, Seeley [2].

Skull relatively very large, with short rostrum, and broad spatulate mandibular symphysis of moderate length (fig. 47, B), the premaxillary and symphysial teeth being enlarged. Teeth carinated,

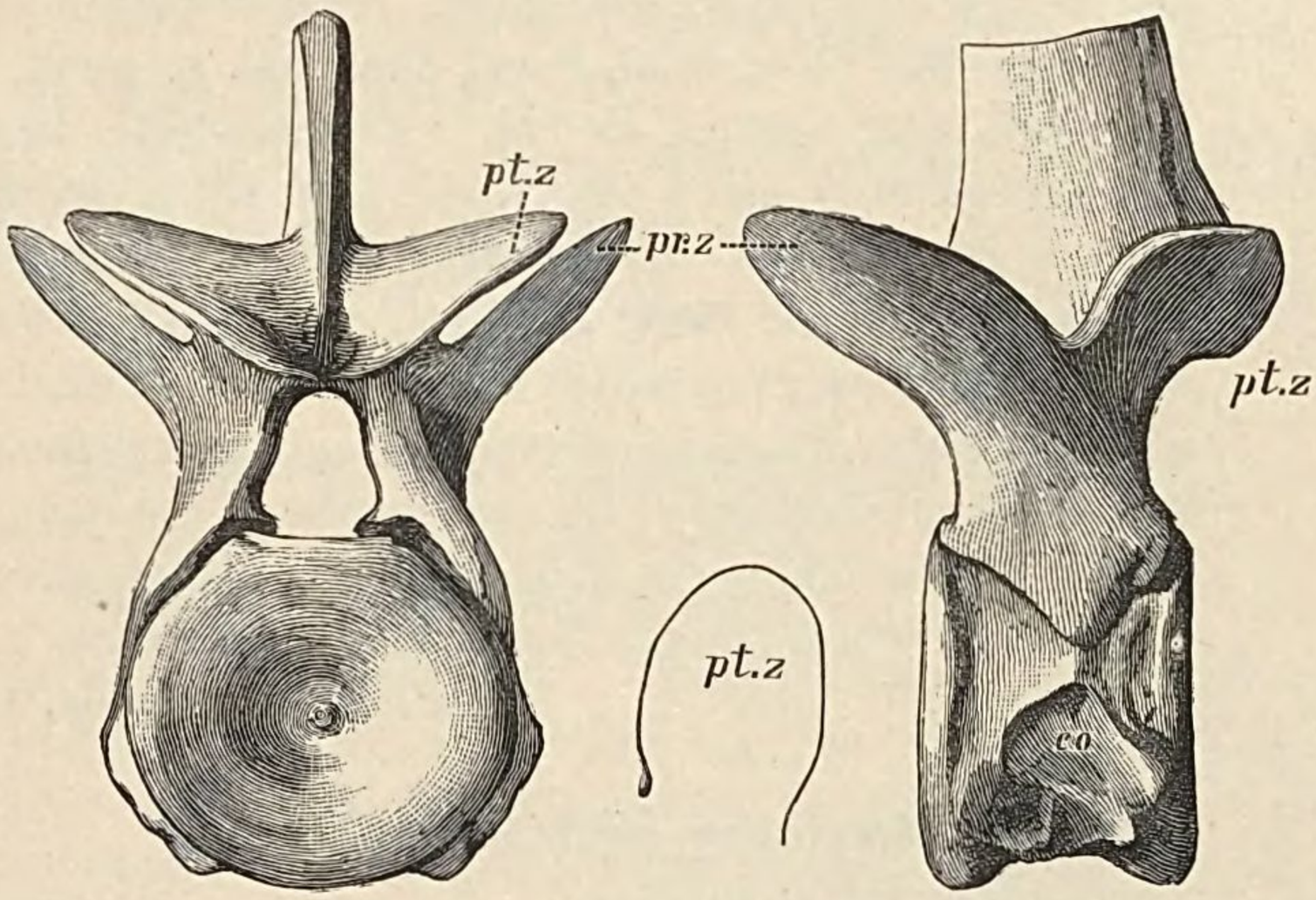
[1] Neues Jahrb. 1841, p. 176.

[2] Quart. Journ. Geol. Soc. vol. xxx. p. 448 (1874).

with the intercarinal space generally flattened, and its ridges less numerous than elsewhere. Neck short, with the anterior vertebræ large. Cervical vertebræ with very short centra, bearing a strong hæmal ridge, with rugose external surface, and having elliptical or circular and well-cupped terminal faces, and distinctly double sessile costal facets; and the arches either very short or moderately elongated. Dorsal centra short. In the pectoral girdle (when known) the scapulæ resembling those of *Plesiosaurus*, but the omosternum consisting of a large single plate, much expanded transversely, with a wide and shallow anterior notch. In the pelvis (when known) the ischium of the comparatively short type of *Plesiosaurus*. Humerus longer or shorter than femur, and distally articulating only with the radius and ulna, which are elongated and separated by a considerable interval; ulna and fibula more or less reniform, and the femur in some cases longer than the latter. Chevrons (if rightly determined) closed inferiorly.

This genus was founded upon the evidence of imperfect teeth and cervical and dorsal vertebræ from the Great Oolite of Würtemberg. The cervical vertebræ show the deeply cupped and nearly circular centra found in the so-called *Rhomaleosaurus*, and are quite distinct from those of *Pliosaurus*, with which they have been said to be identical [1].

Fig. 56.



Thaumatosaurus arcuatus.—Left lateral and posterior aspects of an anterior cervical vertebra; from the Lower Lias of Street. $\frac{1}{2}$. *pr.z*, prezygapophysis; *pt.z*, postzygapophysis; *co*, costal facets. The middle figure shows the articulating surface of the postzygapophysis.

[1] Quart. Journ. Geol. Soc. vol. xlv. p. 58 (1889).

Group A.—The arches of the cervical vertebræ (fig. 56) very tall and short antero-posteriorly, with the longer axis of the zygapophyses directed transversely, and the pre- and postzygapophyses either in contact or separated by a very short and deep notch; posterior border of neural spine above intervertebral space.

Serial position uncertain.

Thaumatosaurus indicus, Lydekker [1].

Syn. *Plesiosaurus indicus*, Lydekker [2].

Known only by the mandibular symphysis, which, allowing for the effects of pressure in the latter, cannot be specifically distinguished from the type mandible of *T. arcuatus*, although the difference in the geological horizon of the two forms probably indicates specific distinction.

Whether this and the following species belong to the first or second group cannot be determined until the arches of the cervical vertebræ are known.

Hab. India.

R. 1401. Cast of the mandibular symphysis. The original, which is the type, and is preserved in the Indian Museum, Calcutta, was obtained from the Umia stage (Upper Jurassic) of the Upper Gondwanas of Kach. It is described by the writer in the 'Rec. Geol. Surv. Ind.' vol. x. p. 41, and described and figured in the 'Palæontologia Indica' (Mem. Geol. Surv. Ind.), ser. iv. vol. i. pt. iii. p. 28, pl. vi. fig. 1, as *Plesiosaurus*. It was referred to the present genus in the 'Rec. Geol. Surv. Ind.' vol. xxii. p. 50, where a restored figure is given which is reproduced in woodcut fig. 47, B (p. 150). There is a diamond-shaped protuberance at the posterior extremity of the oral surface of the symphysis similar to one existing in *T. arcuatus* No. 2030*, although the latter has been longitudinally split by pressure.

Made in the Museum, 1888.

Thaumatosaurus oölithicus, Meyer [3].

Syn. *Liopleurodon bucklandi*, Sauvage [4].

The type species. Imperfectly known, but probably attaining

[1] Rec. Geol. Surv. Ind. vol. x. p. 41 (1877).—*Plesiosaurus.* [2] *Loc. cit.*
[3] Neues Jahrb. 1841, p. 176.
[4] Bull. Soc. Géol. France, sér. 3, vol. i. p. 378 (1873).

dimensions nearly or quite as large as those of *T. cramptoni*. Teeth long and slender, with slight curvature of the crown, and the ridges on the concave surface wide apart and stopping short at the summit, the carinæ being strongly developed.

The transverse diameter of one of the typical dorsal vertebræ is 0,114 (4·5 inches); this is smaller than in the dorsals of the type of *T. cramptoni*, but the fragments of jaws figured by Meyer indicate individuals apparently quite as large as the latter, the same being indicated by some of the undermentioned teeth. The types are figured in the 'Palæontographica,' vol. vi. pls. iv., v., where the subcylindrical terminal faces and the two costal facets of the cervical vertebræ are well shown.

Hab. Europe (Würtemberg and France).

32608. The crowns of four teeth; from the Great Oolite (Lower Jurassic) of Caen, Calvados, France. A similar specimen is figured by Deslongchamps in the 'Mém. Soc. Linn. Normandie,' vol. vi. pl. vi. fig. 8 (1836), where it is referred to *Megalosaurus* (*Poekilopleuron*) *bucklandi*. The fragment of the type tooth figured by Meyer in the 'Palæontographica,' vol. vi. pl. iv. fig. 7, seems to agree exactly with these specimens. Except for their larger size, these teeth are scarcely distinguishable from those of *Peloneustes philarchus*, and appear identical with those of *T. cramptoni*. They are noticed by the writer in the 'Quart. Journ. Geol. Soc.' vol. xlv. p. 50.

Tesson Collection. Purchased, 1857.

27483. A similar tooth; from Caen.

Hastings Collection. Purchased, 1855.

Thaumatosaurus cramptoni (Carte & Baily [1]).

Syn. *Plesiosaurus cramptoni*, Carte & Baily [2].
Rhomaleosaurus cramptoni, Seeley [3].

The type of *Rhomaleosaurus*. Of gigantic size; the length of the type skeleton as it lies being 22 feet 4 inches. From 25 to 30 teeth, which are apparently similar to those of *T. oölithicus*. About 92 vertebræ (some of the caudals being perhaps wanting), which are reckoned as 27 cervical, 30 "pectoral" and dorsal, and 34 caudals. Humerus shorter than femur. Three bones in each row of the carpus and tarsus. Pectoral and pelvic girdles unknown. Cervical

[1] Journ. R. Dublin Soc. vol. iv. p. 161 (1863).—*Plesiosaurus*. [2] *Loc. cit.*
[3] Quart. Journ. Geol. Soc. vol. xxx. p. 448 (1874).

vertebræ with no notch between the pre- and postzygapophyses of the same side, and their centra extremely short.

Hab. Europe (England).

P. 34. Cast of a slab containing the nearly entire skeleton, of which the dorsal aspect is exposed. The original, which is the type, was obtained in 1848 from the Upper Lias of Kettleness, near Whitby, Yorkshire, and is preserved in the Museum of Science and Art, Dublin. It is figured by Carte and Baily in the 'Trans. R. Dublin Soc.' vol. vi. pl. vi., the skull and the last (27th) cervical vertebra being figured in pl. vii.; and also by Haughton in his 'Manual of Geology,' 2nd ed. fig. 38, p. 273 (1866). Length of skull 1,020 (40 inches). Dimensions of 27th cervical vertebra:—length of centrum 0,061 (2·4 inches), height 0,112 (4·4 inches), width 0,114 (4·5 inches). In the present state of the cast, a fibula is placed in the right pectoral limb in place of the ulna, and in the figures there is also some misarrangement of the limbs.

Purchased, 1880.

R. 1008. An anterior cervical vertebra; from the Upper Lias of Whitby, Yorkshire. A considerable portion of the left side of the centrum is wanting. This specimen indicates a smaller individual than the type; the dimensions of the centrum being, length 0,037 (1·45 inches), height 0,086 (3·4 inches). Its resemblance to the imperfect larger and later cervical of the type species figured by Meyer in the 'Palæontographica,' vol. vi. pl. v. figs. 1, 2, is so close as to show not even specific distinction. The costal facet, although somewhat badly preserved, shows its division very clearly; and the characteristic features of the arch are also well exhibited. *No history.*

R. 1365. Two bones, which are apparently chevrons of this species; from Whitby. These specimens are of very large size, and have facets for mutual articulation. So far as can be seen from the cast, they apparently accord with the chevrons in the anterior caudal region of the type.

No history.

40123. A smaller bone of similar type; probably from Whitby.

Purchased.

47154. An immature fibula probably belonging to this species; from the Upper Lias of Kingsthorpe, Northamptonshire.

The rugosity of the edges shows the immature condition of this specimen. *Sharp Collection. Purchased*, 1876.

R. 1378. An immature ulna or fibula probably belonging to this species; from the Upper Lias, locality unknown. The extreme length of this specimen, which is crushed flat, is 0,126 (5·0 inches). *No history.*

Thaumatosaurus arcuatus (Owen [1]).

Syn. *Plesiosaurus arcuatus*, Owen [2].

Imperfectly known. Approaching in size to *T. megacephalus*, but with a relatively smaller skull and larger limb-bones, the humerus being considerably larger than the femur, and the radius and ulna much longer than the tibia and fibula. Coracoid elongated. Crowns of teeth much curved, with the ridges on the inner concave surface approximated and extending to the summits, and the carinæ only slightly developed. Cervical vertebræ with a notch between the pre- and postzygapophyses, and their centra relatively longer than in *T. cramptoni*.

Hab. Europe (England).

2030*. The greater portion of the dentary bone of the mandible in a (*Fig.*) somewhat flattened condition; from the Lower Lias, probably of Street, near Glastonbury, Somersetshire. One of the types. Figured by Hawkins in his 'Memoirs on Ichthyosauri and Plesiosauri' and 'Great Sea Dragons,' pl. xxvi., and also by Buckland in his 'Geology and Mineralogy' (Bridgewater Treatise), pl. xix. figs. 3, 4; and described by Owen in the 'Rep. Brit. Assoc.' for 1839, p. 76. Most of the teeth are wanting, but the traces of some remain in the symphysis, and there are several replacing teeth in the alveoli in this region. There are six enlarged tooth-sockets; and the length of the ventral aspect of the symphysis is 0,082 (3·25). In the type mandible of *T. megacephalus*, the corresponding dimension is 0,120 (4·75 inches); the two specimens agreeing so clearly in contour that the difference in size forms the only apparent distinction. The present specimen closely resembles the mandible of *T. indicus*, but the dental alveoli have become flattened, and the diamond-shaped prominence on the oral surface of the symphysis has been split by pressure. Buckland states that this specimen is from Lyme-Regis.

Hawkins Collection. Purchased, 1834.

[1] Rep. Brit. Assoc. for 1839, p. 75 (1840).—*Plesiosaurus.* [2] *Loc. cit.*

2028*. The imperfect omosternum; probably from Street. Asso-
(*Fig.*) ciated with the preceding. One of the types. Described by Owen, *loc. cit.*, and figured by Hawkins, *loc. cit.* This specimen closely resembles the omosternum of the type skeleton of *T. megacephalus*, but the anterior notch appears somewhat less deep. *Hawkins Collection.*

2029*. The right coracoid, wanting the preglenoidal portion; asso-
(*Fig.*) ciated with the preceding specimen. One of the types. Figured by Hawkins, *loc. cit.*, and noticed by Owen, *loc. cit.* The transverse diameter from the inner border to the glenoid cavity is 0,203 (8 inches), or nearly the same as in the type skeleton of *T. megacephalus*. *Hawkins Collection.*

2027*. Slab showing a dorsal and a caudal vertebra, the right femur,
(*Fig.*) and a phalangeal; associated with the preceding. Figured by Hawkins, *loc. cit.*, and noticed by Owen, *loc. cit.* The length of the femur is 0,332 (13 inches), and its distal diameter 0,174 (6·7 inches). *Hawkins Collection.*

R. 1317. Slab showing the left scapula, the left coracoid, left humerus, left femur, the arch and spine of a dorsal vertebra, a lumbar vertebra, the centra of two caudals, and a rib, together with a humerus and radius of *Ichthyosaurus intermedius*; from Street. The coracoid and femur agree precisely with Nos. 2027* and 2028*, and it appears most probable that the two specimens belong to the same individual. The length of the femur is 0,367 (14·5 inches), and the diameter of the distal extremity 0,190 (7·5 inches). The humerus is noticed by Owen, *op. cit.* p. 76, and this specimen may therefore be regarded as one of the types.
Hawkins Collection.

R. 1318. Slab showing several teeth, cervical, pectoral, dorsal, and
(*Fig.*) caudal vertebræ, ribs, abdominal ribs, the three bones of one side of the pelvis, an ulna, a fibula, the two tibiæ, and some phalangeals; probably from Street. These bones apparently belong to the same individual as the preceding. A late cervical vertebra is described by Owen, *op. cit.* p. 76, and figured by him in the 'Trans. Geol. Soc.' ser. 2, vol. v. pl. xliv. fig. 5. The cervical vertebræ show the short centra, with nearly circular and distinctly cupped terminal faces, high neural arch, and approximated zygapophyses; and have a distinct hæmal ridge. The dimensions of the

ulna are:—length 0,138 (5·4 inches), breadth 0,095 (3·7 inches), length of chord of anterior concavity 0,99 (3·9 inches); and those of the fibula:—length 0,102 (4·0 inches), width 0,082 (3·25 inches), length of chord of anterior concavity 0,050 (2·0 inches). The disproportion in the size of the ulna and fibula is thus strongly shown; the former bone is comparatively long and narrow. The tibia is very small. *Hawkins Collection.*

2061*. (*Fig.*) Fragment of rock containing an anterior cervical vertebra and a radius; probably from Street. The vertebra is represented in fig. 56, p. 159. The radius has a length of 0,127 (5·3 inches), and is longer than the corresponding bone of *T. megacephalus*. This specimen probably belongs to the same individual as the preceding.

Hawkins Collection.

2047*. A laterally crushed anterior cervical vertebra, probably associated with the preceding. *Hawkins Collection.*

R. 1319. Slab showing two teeth and two imperfect ribs; probably from Street. The larger tooth resembles the teeth of No. R. 1318. These bones may also have belonged to the same individual as the preceding specimens.

Hawkins Collection.

Of the following specimens some may belong to the next species.

R. 1320. An imperfect left scapula probably belonging either to this or the next species; probably from Street. A large part of the ventral surface is wanting. This specimen agrees generally with the corresponding bone of No. R. 1317, but presents slight differences which may be specific.

No history.

R. 1323. The crown of a tooth in matrix; from the Lower Lias, locality unknown. This specimen appears to accord with the broken tooth in No. 2030*, and also agrees in size with the teeth of the type of *T. megacephalus*, and since it is of larger size than those of other Lower Liassic Sauropterygians, the reference to the present or the next species is very probable. The crown is much curved, with fine ridges on the inner concave side, while the outer convex surface is nearly smooth; the latter character agreeing with Stutchbury's description of the teeth of the Bristol skeleton of the next species. *No history.*

R. 1324. The crown of a tooth of similar type; from the Lower Lias. The convex surface is less smooth than in the preceding specimen. *No history.*

40094. The crown of a similar tooth in matrix; from the Lower Lias of Lyme-Regis, Dorsetshire. *Purchased*, 1865.

2124*. The crown of a rather smaller tooth in matrix; from Lyme-Regis. *Hawkins Collection.* *Purchased*, 1834.

R. 1325. Fragment of rock showing the concave surface of the crown of a tooth; from the Lower Lias. *No history.*

R. 1326. The somewhat crushed crown of a similar tooth; from the Lower Lias. The convex surface is nearly smooth. *No history.*

R. 1327. The crown of a tooth of similar type in matrix; from the Lower Lias. *No history.*

Thaumatosaurus megacephalus (Stutchbury [1]).

Syn. *Plesiosaurus megacephalus*, Stutchbury [2].

Considerably smaller than *T. cramptoni*, the length of the type skeleton being 16 feet and that of the skull 30 inches. Cervico-dorsal vertebræ 58 in number, of which some 27 [3] are probably cervical; total number of vertebræ 92. Apparently closely allied to *T. arcuatus*, but with a relatively larger skull and proportionately smaller pectoral limbs; and the radius and ulna scarcely exceeding the tibia and fibula in size, and apparently a shorter coracoid. Three bones in each row of the carpus and tarsus.

It appears difficult to believe that the above-mentioned differences from *T. arcuatus* can be due to sex.

Hab. Europe (England).

R. 1309. Cast of the ventral aspect of the skull and of the right pectoral limb. The original belongs to the type skeleton, which was obtained from the Lower Lias of Somersetshire and is preserved in the Bristol Museum. The entire skeleton is figured by Stutchbury in the 'Quart. Journ. Geol. Soc.' vol. ii. pl. xviii.; the skull being also figured by Sollas in vol. xxxvii. pp. 472–478, figs. 8–14. The resemblance of the mandible to that of *T. arcuatus* is mentioned under that heading, where the difference in the

[1] Quart. Journ. Geol. Soc. vol. ii. p. 412 (1846).—*Plesiosaurus.* [2] *Loc. cit.*

[3] Sollas, 'Quart. Journ. Geol. Soc.' vol. xxxvii. p. 469, gives the number of cervicals as 30, but this is probably too high.

dimensions is also noticed. The humerus has a length of 0,350 (13·7 inches), and a width at the distal extremity of 0,178 (7·0 inches), and is thus absolutely smaller than in *T. arcuatus*, while the skull is so much larger. The ulna is relatively shorter and wider than in that species, its length being 0,103 (4·1 inches) and its width 0,081 (3·2 inches), and the disproportion between this bone and the fibula is much less marked; while the radius and tibia are subequal in size. The cervical vertebræ and the pectoral girdle of this skeleton are of the general type of *T. arcuatus*.

Presented by the Trustees of the Bristol Museum.

R. 1322. Slab showing the ventral aspect of a somewhat imperfect omosternum, provisionally referred to this species; from the Lower Lias, locality unknown. This specimen closely accords in general characters with the corresponding bone of *T. arcuatus*, but is of somewhat larger dimensions, although its apparent size has been somewhat increased by the flattening to which its lateral borders have been subjected. The diameter of the anterior border is about 0,178 (7 inches). Slight differences of contour as compared with the above-mentioned specimen suggest reference to the present rather than the preceding species. *No history.*

Group B.—The arches of the cervical vertebræ low and antero-posteriorly elongated, with the longer axis of the zygapophyses directed antero-posteriorly, and the pre- and postzygapophyses separated by a long and shallow notch; posterior border of neural spine above centrum of succeeding vertebra.

This group connects the preceding with *Plesiosaurus*, in which the arches of the cervical vertebræ have a similar structure.

Thaumatosaurus zetlandicus (Phillips [1]), from the highest zone of the Upper Lias, not improbably belongs to this group, since the vertebræ as described by Blake [2] are longer than those of *T. cramptoni*. The skull has a length of 1,065 (42 inches), being absolutely longer than in *T. cramptoni*, although the length of the vertebral column (19 feet) is less. There are said to be 25 cervical vertebræ, and 58 in the united cervical and dorsal series.

[1] Rep. Yorks. Phil. Soc. for 1853, p. 7 (1854).—*Plesiosaurus*. See Blake in Tate and Blake's 'Yorkshire Lias,' p. 249 (1876).—*P. zetlandi*.

[2] In this description it appears that *T. megacephalus* has been confused with *Plesiosaurus macrocephalus*.

Thaumatosaurus carinatus (Cuvier[1]).

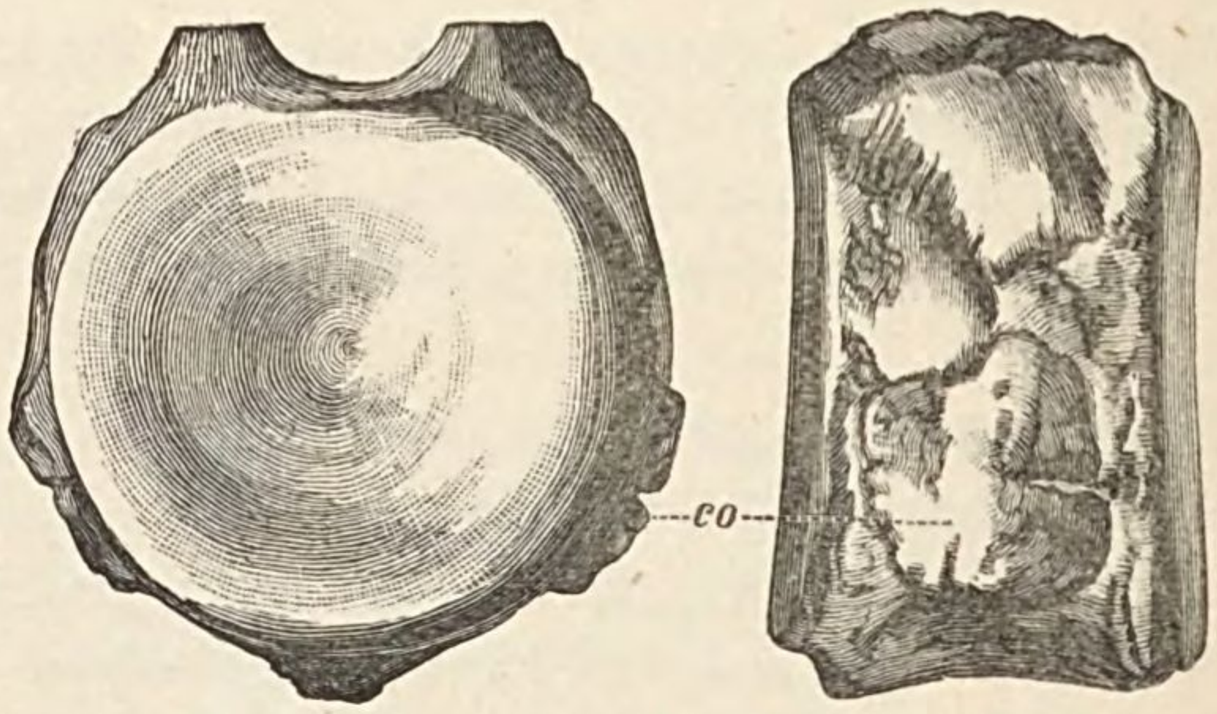
Syn. *Plesiosaurus carinatus*, Cuvier[2].

Imperfectly known, but apparently of the approximate size of *T. indicus*. The cervical vertebræ have a very prominent hæmal carina, with a deep pit on either side.

Hab. Europe (France and England).

R. 1066. The centrum of an immature cervical vertebra; probably from the Kimeridge Clay of England. This specimen, which is apparently late in the series, agrees almost exactly with the immature type cervical from the Kimeridgian of Boulogne, which is figured by Sauvage in the 'Ann. Sci. Nat.'—Zool. sér. 6, vol. viii. pl. xxvi. fig. 2 (1879), of which the dimensions are:—length 0,043 (1·7 inches), height 0,055 (2·15 inches), width 0,058 (2·3 inches). In the type the division of the costal facet is not clearly shown, although this is indicated by its vertical dimension; in the present specimen the division is very distinct. The pits on either side of the carina are very deep, and the rugosities on the terminal borders of the inferior face very distinct. The cupping of the terminal faces and the absence of prominence in the costal facets distinguish this specimen from the cervicals of *Peloneustes*. *Purchased*, 1888.

Fig. 57.



Thaumatosaurus (*cf.*) *carinatus*.—Anterior and left lateral aspects of the centrum and base of the arch of a cervical vertebra; from the Kimeridge Clay of Shotover. ½. *co*, costal facets.

[1] Ossemens Fossiles, 2nd ed. vol. v. pt. ii. p. 486 (1824).—*Plesiosaurus*.
[2] *Loc. cit.*

31908. (*Fig.*) The centrum and base of the arch of a (middle ?) cervical vertebra, provisionally referred to this species; from the Kimeridge Clay of Shotover, near Oxford. The dimensions of this specimen (woodcut fig. 57), are :—length 0,045 (1·76 inches), height 0,062 (2·45 inches), width 0,068 (2·67 inches). The base of the arch is anchylosed to the centrum, although the suture persists. The costal articulation is divided into two at the posterior half by a line which does not extend to the anterior border. The hæmal carina terminates in a spine on the anterior border. The resemblance to the cervicals of *T. oölithicus* figured by Meyer in the 'Palæontographica,' vol. vi. pl. v., is very marked, and the specimen also presents a considerable general resemblance to the preceding, but has nearly circular terminal faces and less distinct hæmal pits. It is uncertain whether these points are merely due to difference of serial position or are of specific value.

Purchased. About 1852

37300. Two nearly entire late cervical vertebræ of a large individual: from the Kimeridge Clay of Boulogne, France. These specimens, except for their large size, agree precisely with those of the type, showing the extremely deep pits on either side of the hæmal ridge. The arches are anchylosed to the centra, and the double costal facets are distinctly shown. In the hinder vertebra the terminal faces are ellipsoidal. *Purchased*, 1863.

32778. The centrum of a "pectoral" vertebra probably referable to this species; from the Kimeridge Clay of Boulogne. There is a distinct hæmal ridge. *Purchased.*

41776. The centrum of an anterior dorsal vertebra provisionally referred to the present form [1]; from the Kimeridge Clay of the Isle of Portland, Dorsetshire. Although somewhat smaller this specimen closely resembles the dorsal of the type species figured by Meyer, *op. cit.* pl. v. figs. 8–10.

Purchased, 1869.

31900. The centrum of a later dorsal vertebra, apparently specifically identical with the preceding; from the Kimeridge Clay of Shotover. *Purchased. About* 1852.

[1] It is not certain that this and the two next specimens are not referable to the so-called *Plesiosaurus ellipsospondylus* (*infrà*, p. 172).

44598. Six associated centra of caudal vertebræ provisionally referred to this form ; from the Kimeridge Clay of Swindon, Wiltshire. These specimens comprise one anterior centrum of which the dimensions are :—length 0,043 (1·7 inches), height 0,070 (2·75 inches), width 0,074 (2·93 inches) ; then there is an interval, after which we come to three anterior caudals in sequence : then another interval, followed by two middle caudals, the dimensions of the larger being, length 0,044 (1·75 inches), height 0,053 (2·08 inches), width 0,054 (2·15 inches). The anterior ones have no distinct chevron-facets, but these are strongly marked in the later centra. These specimens closely resemble the caudals of *T. cramptoni*, and are totally different from those of the Kimeridgian species of *Cimoliosaurus*. *Presented by the Directors of the Swindon Brick and Tile Company*, 1873.

Thaumatosaurus propinquus (Blake [1]).

Syn. *Plesiosaurus propinquus*, Blake [2].
Plesiosaurus simpsoni, Blake [3].

Nearly of the dimensions of *T. arcuatus*, the total length of the type skeleton being 15 feet. About 25 cervical vertebræ, which are described by Blake [4] as being relatively longer than in that species, with the neural spines more widely separated. There are said to be seven bones in the carpus—3 in the first, and 4 in the distal row ; but the arrangement of the bones of the distal row in Blake's figure appears to be incorrect, and the bones articulating with the left humerus seem to be either two radii, or a radius and a tibia.

The type specimen is in the Museum at Whitby, and was obtained from the base of the Upper Lias.

Hab. Europe (England).

16046. Two conjoint imperfect cervical vertebræ probably belonging to this species ; from the Upper Lias of Crick, Northamptonshire. These specimens have lost the neural spines, while the exposed terminal face of each is also missing. They differ from the nearly equal-sized vertebræ of *T. arcuatus*, No. 2061*, by the characters of the neural

[1] In Tate and Blake's ' Yorkshire Lias,' p. 247 (1876).—*Plesiosaurus.*
[2] *Loc. cit.* [3] *Ibid.* Index of synonyms, p. i.—*Errorim.*
[4] Erroneously compared with *Plesiosaurus macrocephalus*, see note, p. 167.

arches, which are of the type mentioned above. In this respect they accord with the description of the cervicals of the type, and are therefore referred to this species.

Purchased. About 1840.

R. 1321. Five imperfect cervical vertebræ of similar type cemented together by matrix; from the Marlstone (Middle Lias), locality unknown. The characteristic contour of the arches and the position of the neural spine is well shown; while the characters of the centra distinguish them from *Plesiosaurus*. The identity in their mineral condition and the nature of their matrix with that of the next specimen indicates their geological horizon.

Presented by C. Faulkner, Esq.

16059. An immature and rolled dorsal vertebra; from the Marlstone of Bugbrook, Northamptonshire. The dimensions of the centrum are:—length 0,030 (1·2 inches), height 0,054 (2·15 inches), width 0,052 (2·05 inches). In the extreme shortness of the centrum this specimen differs from the dorsals of all species of *Plesiosaurus* and agrees with those of *T. cramptoni*. *Purchased. About* 1840.

R. 1369. An imperfect right scapula probably belonging to this form; from the Upper Lias, probably of Northamptonshire. This specimen is of the general type of the corresponding bone of *T. arcuatus*, although presenting well-marked specific differences in the contour of the glenoidal extremity. *No history.*

33098–9. The proximal extremity of a humerus or femur and an associated radius or tibia, probably belonging to this species; from the Upper Lias of Whitby. These specimens are much smaller than the corresponding bones of *T. cramptoni*, and would apparently accord with those of the present species. *Purchased. About* 1860.

33115. Four imperfect caudal vertebræ and some phalangeals, cemented together by matrix, and probably associated with the preceding; from Whitby. In the shortness of their centra these bones agree with the caudals of *T. megacephalus*. Two of the chevrons are in position.

Purchased. About 1860.

Genus non det.

(*Plesiosaurus ellipsospondylus*, Phillips [1].)

Very imperfectly known; of large dimensions. Cervical vertebræ with short centra, having transversely ellipsoidal and slightly cupped terminal faces, with single costal facets, and the costo-central suture persistent.

Hab. Europe (England).

31916. The centrum of a cervical vertebra; from the Kimeridge Clay of Shotover, near Oxford. Length 0,066 (2·6 inches), width 0,096 (3·8 inches), height 0,076 (3·0 inches). These dimensions accord very closely with those of the largest cervical described by Phillips. The suture between the rib and the centrum is very apparent.

Purchased. About 1852.

Genus **POLYPTYCHODON,** Owen [2].

Syn. *Lutkesaurus*, Kiprijanoff [3].

Skull imperfectly known, but relatively large and of moderate elongation. Teeth (fig. 58) large and stout with conical crowns, marked by a number of prominent vertical ridges on all sides. Neck probably short, with the anterior vertebræ large. Cervical vertebræ with centra of medium length, having the terminal faces flattened, with a sinuous profile caused by the overhang of the upper border of the anterior face and the prominence of the lower border of the same; costal facets single, and neural arch and cervical ribs anchylosed to centrum. Dorsals [4] with the same forward overhang of the upper part of the centrum, and a mammilla in the centre of the terminal faces. Pectoral and pelvic girdles unknown. The limb referred by Kiprijanoff to the so-called *Lutkesaurus* agrees very closely with that of *Cimoliosaurus portlandicus*.

This genus is probably derived from *Cimoliosaurus*, with which it agrees in the general structure of the teeth and vertebræ.

[1] Geology of Oxford, p. 372 (1871).—*Ex* Owen, MS.
[2] Odontography, pt. ii. pl. 72. figs. 3, 4 (1841).
[3] Mém. Ac. Imp. St. Pétersbourg, vol. xxxi. art. 6, p. 35 (1883).
[4] See Seeley, Quart. Journ. Geol. Soc. vol. xxxii. p. 433.

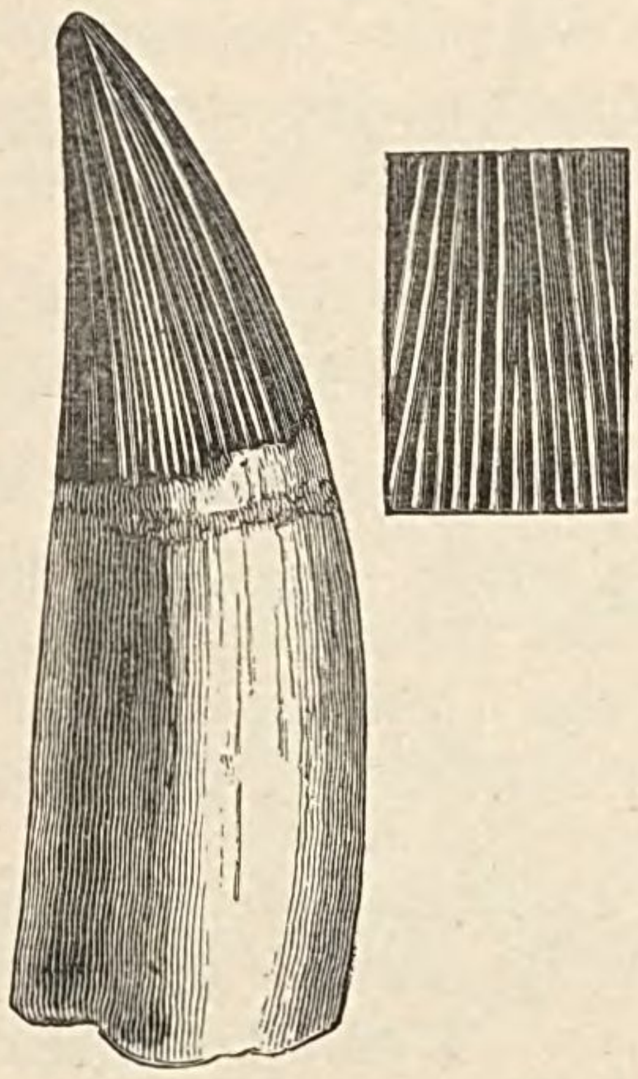
Polyptychodon interruptus, Owen [1].

The type species [2]. Typically the ridges on the enamel of the teeth (fig. 58) placed at a considerable distance apart, and a large number of them, especially on the convex side, not extending to the summit. Other teeth show a transition to the next form.

The horizon of the type specimen is not mentioned.

Hab. Europe (England, France [3], Germany [4], Bohemia [4], and Russia [4]).

Fig. 58.



Polyptychodon interruptus.—Tooth; from the Cambridge Greensand. ½. A portion of the enamel of the crown is shown on the right, of the natural size.

The following specimens are from the Upper Chalk; in many of them the ridges on the enamel are more approximated and finer than in the specimens from the Cambridge Greensand.

49011. (*Fig.*) The right half of the anterior extremity of the mandibular symphysis, showing one entire tooth of medium size and the alveolus of a second; from Kent. Figured in Dixon's 'Geology of Sussex,' 1st ed. pl. xxxviii. fig. 3, and also by Owen in his 'Cretaceous Reptilia' (Mon. Pal. Soc.), pt. i. pl. x. fig. 7 (1851). *Purchased*, 1878.

[1] Odontography, Atlas, pt. ii. p. 19, pl. 72. fig. 4 (1841).

[2] The name *P. continuus* occurs first in the original description, but it seems preferable to take the present and better known form as the type.

[3] Sauvage, Mém. Soc. Géol. France, sér. 3, vol. ii. art. 4, p. 27.

[4] *Vide infrà.*

25761. Part of the crown of a comparatively large tooth; from Sussex. Figured in Dixon's 'Geology of Sussex,' pl. xxx. fig. 22. *Dixon Collection. Purchased*, 1851.
(*Fig.*)

25830. The nearly entire crown of a large tooth; from Sussex. A characteristic specimen. *Dixon Collection.*

35103. The nearly entire crown and a fragment of the root of a very large tooth; from Rochester, Kent. The length of the crown is 0,075. *Purchased*, 1860.

49912. The crown of an equally large but shorter tooth; from Kent. The ridges are fine and closely approximated at the base, but are large and widely separated at the summit. *Capron Collection. Purchased*, 1879.

49913. The crown and part of the root of a small tooth; from Kent. The summit is nearly smooth. *Capron Collection.*

32835. A small tooth belonging either to this or the following species; from Kent. A large proportion of the grooves continue to the summit, but it is difficult to specifically distinguish this tooth from the Cambridge Greensand specimen No. 35379. *Taylor Collection. Purchased.*

43171. The crown of a medium-sized tooth in matrix; from Kent. The length of the crown is greater than in the preceding specimen. *Wetherell Collection. Purchased*, 1871.

47951. The crown of a small tooth in matrix; from Maidstone, Kent. *Presented by the Hon. R. Marsham*, 1877.

47952. The summit and one side of the base of the crown of a large tooth, in matrix; from Maidstone. *Same history.*

47953. The crown of a smaller tooth from which one third has been longitudinally split off, in matrix; from Maidstone. *Same history.*

R. 14. The crown of a large tooth, and fragments of two smaller teeth; from Dover, Kent.
Gardner Collection. Purchased, 1879.

R. 50. The crown of a small tooth; from Hart Hill, Charing, Kent. *Purchased.*

49915. The imperfect crown of a small tooth; from Kent.
Capron Collection.

R. 1216. The crown of a small tooth in matrix; from Kent. The ridges are few and widely separated. *No history.*

41242. Part of the crown of a very small tooth in matrix; from Kent. *Purchased*, 1868.

41897. The broken crown of a larger tooth, in matrix; from Kent. The upper portion is nearly smooth. *Purchased*, 1870.

43081. The imperfect crown of a large tooth; from Cuxton, Kent. *Purchased*, 1871.

41641. The crowns of two teeth (one imperfect); from Burham, Kent. *Purchased*, 1869.

R. 1217. The crown of a small tooth in matrix; from Burham. *No history.*

R. 51. The crown of a small tooth in matrix, provisionally referred to this species; from Charing. The convex side is almost totally devoid of ridges. *Purchased.*

41861. A very similar but slightly larger specimen, in matrix; from near Rochester. *Purchased*, 1869.

5644. The crown of a very similar tooth; from Steyning, Sussex. *Mantell Collection.* *Purchased*, 1838.

5644 a. The imperfect crown of a larger tooth; from Steyning. *Mantell Collection.*

5645. The crown and part of the root of a large tooth in matrix; from Steyning. The enamel is wanting on the convex side. *Mantell Collection.*

49914. The imperfect crown of a small tooth in matrix; from Glynde, Sussex. *Capron Collection.*

49961. The imperfect crown of a small tooth; from Lewes, Sussex. *Capron Collection.*

R. 1264. A number of associated teeth of medium size; together with fragments of bone; from Lewes, Sussex. *Harford Collection.* *Purchased*, 1888.

R. 1265. Five small teeth; from Lewes. *Harford Collection.*

R. 1266. Three imperfect teeth of large size; from Lewes. *Harford Collection.*

R. 1267. A medium-sized tooth in matrix; from Halling, Kent. *Harford Collection.*

The following specimens are from the Lower Chalk.

47259. The imperfect crown of a large tooth in matrix; from Dover. *Gardner Collection.* *Purchased*, 1876.

47259 a. The crown of a smaller tooth in matrix; from Dover. *Gardner Collection.*

46959. The crown of a comparatively small tooth in matrix; from Burham. *Purchased*, 1876.

R. 1271. Two associated small teeth in matrix; from Folkestone, Kent. These are typical examples. *Harford Collection.*

The following specimens are from the Cambridge Greensand, and may be regarded as typical examples.

R. 482. The imperfect crown of a very large tooth. The ridges are comparatively closely approximated. *Presented by Sir R. Owen, K.C.B.*, 1884.

R. 393. The imperfect crown of an equally large tooth. Many of the ridges show the pustules on the summit. *Presented by A. Nesbitt, Esq.*, 1883.

35380. The crown and part of the root of a large tooth. A considerable portion of the enamel has been chipped off. *Purchased*, 1860.

39104. The imperfect crown and part of the root of a very similar tooth. *Bowerbank Collection.* *Purchased*, 1865.

35257. The imperfect crown of a large tooth wanting much of the enamel. *Purchased*, 1859.

35256. The crown of a rather smaller tooth. *Purchased*, 1859.

35379. (*Fig.*) A nearly entire tooth of smaller size. Figured in woodcut, fig. 58 (p. 173). *Purchased*, 1860.

30253. The imperfect crown of a tooth. *Purchased*, 1855.

35269. Part of the crown of a tooth. *Purchased*, 1859.

35270. The crown of a tooth remarkable for its shortness, and probably belonging to the posterior extremity of the jaw. The summit is wanting. *Purchased*, 1859.

35271. The crown of a very similar tooth. The summit of the crown seems to have been abraded by wear. *Purchased*, 1859.

39104 a. The crown of a comparatively large tooth, remarkable for its great length. *Bowerbank Collection.*

35259. The root and base of the crown of a medium-sized tooth. The base of the crown has been absorbed by a successional tooth-germ. *Purchased*, 1859.

35382. The crown of a medium-sized tooth. *Purchased*, 1860.

35260. The crown of a large tooth wanting most of the enamel. *Purchased*, 1859.

35258. The crown and part of the root of a rather smaller tooth. The crown is comparatively short, and has the ridges on the convex surface widely separated. *Purchased*, 1859.

35262. The crown of a medium-sized tooth. *Purchased*, 1859.

30253. The crown of a very similar tooth wanting portions of the enamel. *Purchased*, 1855.

35261. The perfect crown of a tooth noticeable for its elongated shape. *Purchased*, 1859.

41913. The crown of a larger tooth. *Purchased*, 1870.

35263. The imperfect crown of a tooth resembling No. 35261. *Purchased*, 1859.

35264. The imperfect crown of a small tooth. *Purchased*, 1859.

35265. The crown of a rather larger tooth. *Purchased*, 1859.

35266. The crown of a very similar but straighter tooth. The ridges near the summit are very few. *Purchased*, 1859.

35267. The crown of a stouter tooth. *Purchased*, 1860.

35381. The crown of a very similar tooth. *Purchased*, 1860.

41913 a. The greater part of a small tooth. *Purchased*, 1870.

40357. Six specimens of the crowns of medium-sized teeth, to one of which a portion of the root is still attached. *Purchased*, 1867.

R. 1268. The crown of a large tooth. *Harford Collection.*

R. 1269. The imperfect crown of a very large tooth, with one surface worn by the attrition of another tooth. *Harford Collection.*

R. 1270. The crown of a smaller tooth. *Harford Collection.*

47267. The centrum of a small "pectoral" vertebra. This specimen agrees precisely in contour with the larger example figured by Owen in his 'Cretaceous Reptilia' (Mon. Pal. Soc.), suppl. iii. pl. v., exhibiting the same sinuous profile of the terminal faces, caused by the overhanging of the upper border of the anterior face, and the protrusion of the inferior border of the same. *Purchased.*

47272. A more imperfect centrum of a "pectoral" vertebra. *Purchased.*

The following specimens are from the Upper Greensand.

46380. The imperfect crowns of two large teeth; from Warminster, Wiltshire. *Cunnington Collection. Purchased*, 1875.

R. 1219. The crown of a smaller and more elongated tooth; from Wiltshire. *Cracherode Collection. Bequeathed*, 1799.

The following specimens are from the Upper Greensand of Würtemberg.

R. 58. The imperfect crown of a large tooth and the entire crown of a small tooth; from Ratisbon. Teeth from the same locality are described and figured by Meyer in the 'Palæontographica,' vol. vi. p. 1, pl. ii. figs. 10–13, 17. *Purchased*, 1880.

The original of the following specimen is from the Cretaceous of Bohemia.

47499. Cast of a comparatively small tooth in matrix. The concave side of the crown is exposed. It is apparently a restoration of this specimen that is figured by the donor in his 'Reptilien und Fische der böhmischen Kreideformation' (Prague, 1878), p. 1. *Presented by Dr. Anton Fritsch*, 1876.

The following specimens are from the Gault of England.

35543. A tooth with the root imperfect, in matrix; from Folkestone, Kent. The concave surface of the crown is exposed, and the ridges are very widely separated, and thus approach the tooth noticed by Seeley in the 'Quart. Journ. Geol. Soc.' vol. xxxii. p. 436. *Purchased*, 1859.

R. 741. The crown of a taller tooth in matrix; from Folkestone. The convex surface is exposed, and the ridges are widely separated. *Purchased*, 1886.

The following specimen is from the "Osteolite" of Kursk, Russia, the probable equivalent of the Gault.

33246. The crown of a large tooth. Entire teeth from the same deposits are described and figured by Kiprijanoff in the 'Mém. Ac. Imp. St. Pétersbourg,' vol. xxxi. art. 6, p. 7, pls. i., ii. *Presented by Col. Kiprijanoff.*

The following specimen may belong to the present form.

36173. A bone which is apparently the extremity of the left premaxilla; from the Upper Greensand of Shanklin, Isle of Wight. Three dental alveoli and a portion of a fourth remain, the first and fourth being very large. There are large cancelli in the diploë. *Purchased*, 1869.

****Polyptychodon continuus,** Owen [1].

Syn. *Lutkesaurus*, sp., Kiprijanoff [2].

Typically the ridges on the enamel of the teeth finer, more closely approximated, and a larger number continuing to the summit of the crown than in *P. interruptus*.

Specimens catalogued under the latter heading indicate a transition from the present to the preceding form, and it is highly probable, as suggested by Sauvage [3], that the teeth to which the present name has been applied are merely the anterior teeth of *P. interruptus*. The type specimen is, however, said to be from the Lower Greensand, where the latter form is not definitely known. The teeth from the "Osteolite" (Gault) of Russia figured by Kiprijanoff [4], under the name of *Lutkesaurus*, appear indistinguishable from those of the present form. The fragment of a limb figured [5] under the same name has a structure essentially the same as that of *Cimoliosaurus portlandicus* (fig. 70); if it really belong to the present form it would seem to indicate an immature individual.

Hab. Europe (England and Russia).

[1] Odontography, Atlas, pt. ii. p. 19, pl. 72. fig. 13 (1841).
[2] Mém. Ac. Imp. St. Pétersbourg, vol. xxxi. art. 6, p. 35 (1883).
[3] Mém. Soc. Géol. France, sér. 3, vol. ii. art. 4, p. 28.
[4] *Op. cit.* pl. xvii.
[5] *Ibid.* pl. xix.

The undermentioned specimens are referred to the present species by its founder.

32835. (*Fig.*) An imperfect tooth of large size, partly imbedded in matrix; from the Upper Chalk of Kent. Figured by Owen in his 'Cretaceous Reptilia' (Mon. Pal. Soc.) pt. i. pl. xiv. fig. 4 (reversed). This specimen agrees in every respect with the type teeth of *Lutkesaurus* figured by Kiprijanoff in the 'Mém. Ac. Imp. St. Pétersbourg,' vol. xxxi. pl. xvii., showing the same fine and closely approximated ridges, of which the summits carry a series of small pustules.

Taylor Collection.

R. 1215. The broken base of the crown of a similar tooth; from the Chalk of Kent. *No history.*

35268. An imperfect and smaller tooth probably belonging to this form; from the Cambridge Greensand. The ridges have been somewhat worn away by the action of water.

Purchased, 1859.

Genus **CIMOLIOSAURUS,** Leidy [1].

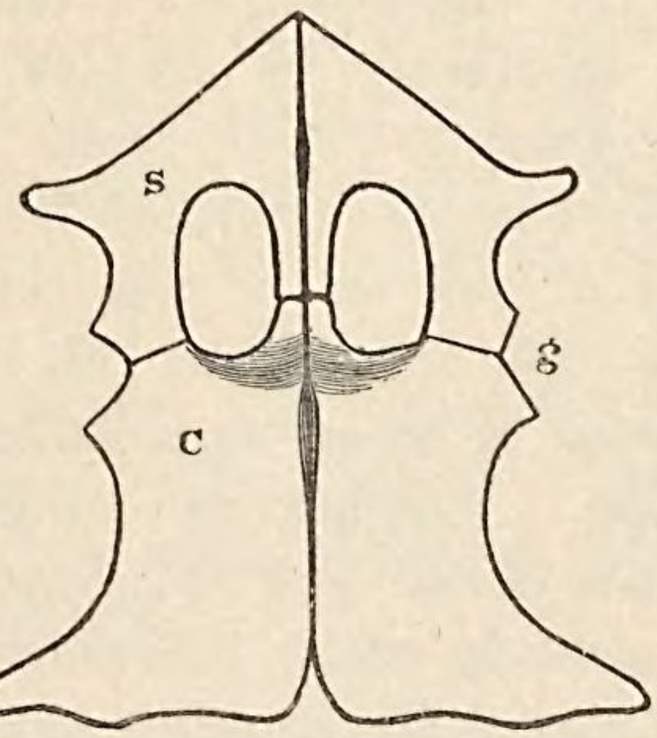
Including:—*Discosaurus*, Leidy [2].
Brimosaurus, Leidy [3].
Elasmosaurus, Cope [4].
Polycotylus, Cope [5].
Mauisaurus, Hector [6].
Muræosaurus, Seeley [7].
Colymbosaurus, Seeley [8].
? *Oligosomus*, Leidy [9].
? *Piptomerus*, Cope [10].
? *Trinacromerum*, Cragin [11].

Skull relatively small, with short mandibular symphysis. Teeth slender and not carinated; the anterior ones not enlarged. Neck usually greatly elongated, with the anterior vertebræ very small. Vertebræ with the arches and cervical ribs usually completely anchylosed to the centrum, with frequent obliteration of the suture, and with curved zygapophyses and strongly developed zygosphenes.

[1] Proc. Ac. Nat. Sci. Philad. for 1851, p. 325 (1852).—Amended.
[2] *Ibid.* p. 326.
[3] *Ibid.* for 1854, p. 72 (1854).
[4] *Ibid.* for 1868, p. 92 (1868).
[5] Trans. Amer. Phil. Soc. vol. xiv. pt. i. p. 34 (1870).
[6] Trans. N. Zealand Inst. vol. vi. p. 346 (1874).
[7] Quart. Journ. Geol. Soc. vol. xxx. p. 197 (1874).
[8] *Ibid.* p. 447.
[9] Proc. Ac. Nat. Sci. Philad. for 1872, p. 39 (1872).
[10] Amer. Nat. vol. xxi. p. 564 (1887).
[11] Amer. Geol. vol. ii. p. 405 (1888).

Cervicals with moderately or very short centra, having only single costal facets (fig. 61), and the terminal faces transversely ellipsoidal

Fig. 59.



Cimoliosaurus (*cf.*) *trochanterius*.—Diagram of the pectoral girdle; from the Kimeridge Clay of Ely. Much reduced. *s*, scapula; *g*, glenoid cavity; *c*, coracoid. (From the 'Quart. Journ. Geol. Soc.')

and more or less cupped. Dorsals with forward overhang of upper part of centrum, and the cupping of the faces corresponding to that of the cervicals. Pectoral girdle (fig. 59) with the scapulæ very large and having very broad and flat ventral plates meeting anteriorly in the median line, and the dorsal portion very small and narrow; no omosternum; coracoids either short and broad, or moderately elongated, usually with a narrow median bar extending forwards to unite with the scapulæ[1]; scapulo-coracoidal foramina large and closed. Pelvis with the ischia (fig. 65) very short and wide. Humerus usually longer than femur, and articulating distally with either two or three bones, which are frequently transversely elongated and lose all resemblance to long bones, the ulna being generally more or less shortened antero-posteriorly and expanded laterally. Chevrons (at least in the typical group) open inferiorly.

The pectoral girdle is imperfectly preserved or unknown in the English Cretaceous species, in which the length of the neck is frequently also unknown.

This genus is provisionally taken to include all the forms having the above-mentioned type of pectoral girdle, with single costal facets to the cervical vertebræ. The type species, *C. magnus* of the North-American Cretaceous, is noticed below; *Discosaurus* has been shown by Cope to be specifically identical, while there appear to be no grounds for generically distinguishing *Elasmosaurus platyurus*, Cope[2]. *Mauisaurus* has vertebræ agreeing precisely in

[1] See Introduction.

[2] Proc. Ac. Nat. Sci. Philad. for 1868, p. 93 (1868). There appears to be a confusion of cervical with caudal vertebræ in the comparison of this form with *Cimoliosaurus*.

general structure with those of the type species. *Polycotylus* of the American Cretaceous is characterized by the deeply cupped terminal faces of the vertebral centra, and probably corresponds, at least in part, to the undermentioned Cœlospondyline group; for which it might apparently be adopted if it be considered advisable to raise that group to generic rank. *Piptomerus* from the same deposits is stated to be distinguished from *Polycotylus* by the absence of anchylosis of the arches and cervical ribs with the centra, but it has yet to be shown that this feature is not due to immaturity. *Oligosomus* is based on a caudal vertebra from the Cretaceous of Wyoming. Whether the forms described by Cope under the names of *Uronautes*[1] and *Orophosaurus*[2] belong to the present genus in the sense in which it is employed here cannot yet be determined. The names *Muræosaurus* and *Colymbosaurus* are noticed in the sequel. *Trinacromerum* from the Cretaceous of Kansas, which is not yet figured, has three bones articulating with the propodials, and the neck is said to be short. Although in the Ichthyopterygia the number of bones articulating with the humerus has been taken as a generic character, yet it seems unadvisable to follow the same course in the present order, since this would lead to making a number of indefinable genera, and would involve the separation of such apparently closely allied forms as *C. trochanterius* and *C. eurymerus*. The species of the two groups are arranged in the order of their sequence in time.

A. *Cœlospondyline Group.*

Vertebræ with the centra short or moderately elongated, and their terminal faces more or less deeply cupped; cervicals with the neural spines short, and the zygosphenes and zygapophyses less complex than in the next group; usually no anchylosis of the chevrons with the caudal centra. Humerus relatively large, frequently much expanded distally, with the trochanter very large and extending obliquely outwards from the shaft; when only radius and ulna articulate with the humerus, the ulna often greatly elongated in the transverse direction.

Probably equivalent, at least in part, to *Polycotylus*[3], Cope; and apparently including *Colymbosaurus*, Seeley[4].

[1] Proc. Ac. Nat. Sci. Philad. for 1876, p. 345 (1876).

[2] Original reference not found; occurs in Amer. Nat. vol. xxi. p. 565 (1887).

[3] In the description in the Amer. Nat. vol. xxi. p. 564, the term *propodials* should be *metapodials*.

[4] Both the detached pectoral girdle (fig. 59) and the skeleton of *Plesiosaurus megadirus* were grouped together in the description of this genus, so that it is difficult to say which is the type (see p. 191).

Cimoliosaurus cantabrigiensis, Lydekker (n. sp.[1]).

Including *Plesiosaurus neocomiensis*, Owen[2] (*non* Pictet and Campiche).

Very imperfectly known; of moderate size. Cervical vertebræ elongated, with the terminal faces of the centra moderately cupped and slightly bevelled at the edges; and the arches having a very prominent lateral ridge descending obliquely from the outer surface of the prezygapophysis to the posterior border of the pedicle. The dorsal vertebræ figured by Owen as *Plesiosaurus neocomiensis* would agree in relative size with the undermentioned cervicals and may belong to the same form; they are characterized by a mammilla in the centre of the terminal face of the centrum.

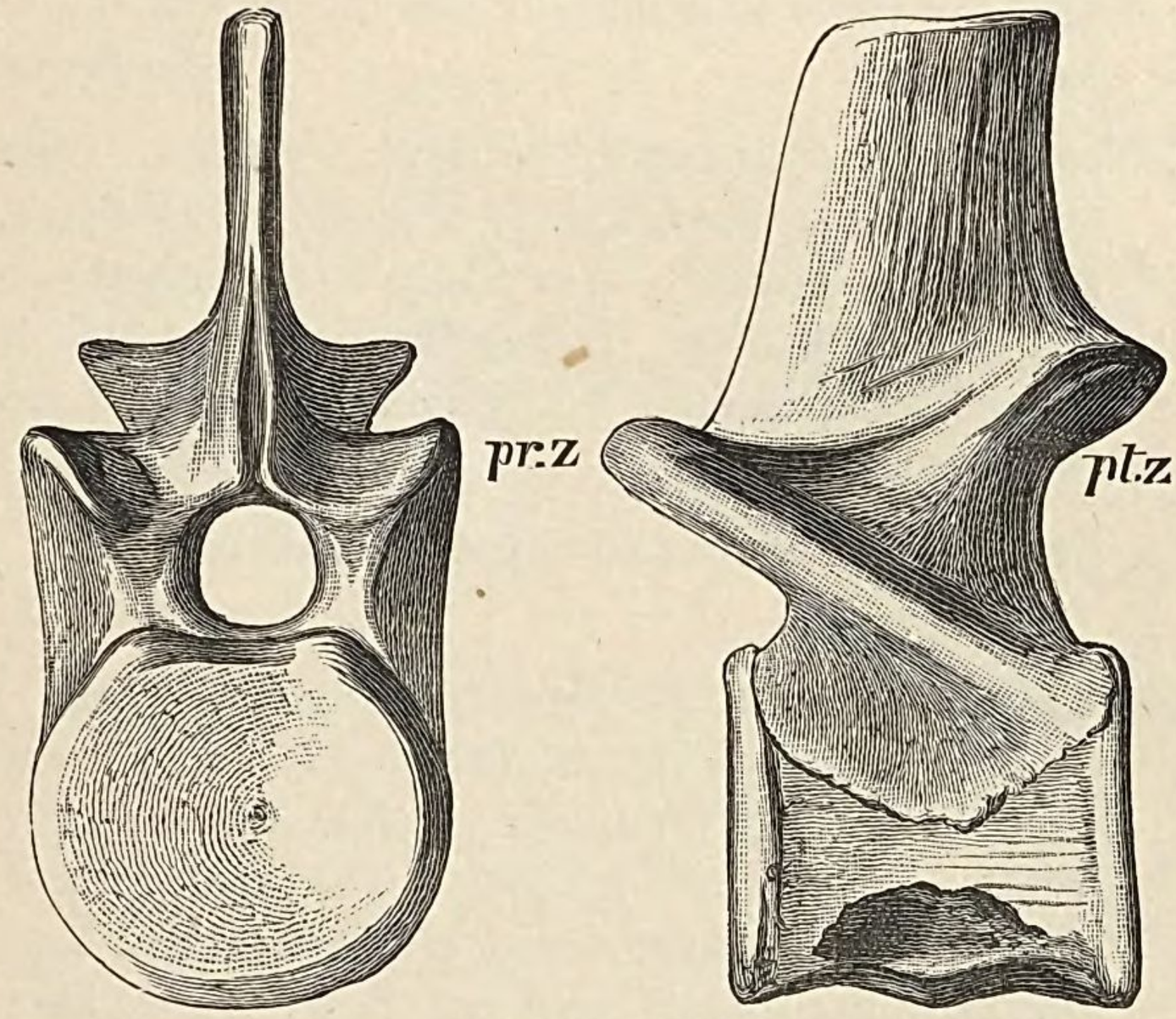
Hab. Europe (England).

The following specimens are from the Cambridge Greensand.

R. 461. Three associated imperfect anterior cervical vertebræ. Length of centrum 0,033 (1·3 inches), height 0,032 (1·25 inches), width 0,034 (1·35 inches).

Presented by Sir R. Owen, K.C.B., 1884.

Fig. 60.



Cimoliosaurus cantabrigiensis.—Anterior and left lateral aspects of a cervical vertebra; from the Cambridge Greensand. ⅔. *pr.z*, pre-, *pt.z*, post-zygapophysis.

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[1] The specific names applied by Seeley in his 'Index &c.' to the Plesiosaur of the Cambridge Greensand are not defined (*vide infrà*, p. 246).

[2] Cretaceous Reptilia (Mon. Pal. Soc.), suppl. iv. p. 11 (1861).

R. 461 a. (*Fig.*) Two larger cervical vertebræ in a less imperfect condition, probably from the later part of the neck of the same individual as the preceding. These specimens (fig. 56) are the types. The dimensions of the centrum are:—length 0,039 (1·54 inches), height 0,034 (1·35 inches), width 0,041 (1·6 inches). If these specimens belong to the same individual as the preceding, and the undermentioned cervicals of *C. bernardi* are likewise associated specimens, the specific distinctness of the two forms will be pretty certain, since in one case all the centra are long, while in the other they are all short. The centra of the present form are much less cupped than in the cervicals of *C. bernardi*, the cupping being most marked posteriorly.

Presented by Sir R. Owen, K.C.B., 1884.

The following specimens, which were referred by Owen to Plesiosaurus neocomiensis, *may be referable to this species.*

35285. The centrum of a small late cervical vertebra. The costal facet on one side is relatively high; the cupping of the terminal faces is the same as in the preceding specimens, but there is a mammilla in the centre, and the length is less.

Purchased, 1859.

36151. (*Fig.*) The centrum of a small "pectoral" vertebra. Figured by Owen, *op. cit.* pl. vi. figs. 7, 8, as *P. neocomiensis*. This specimen is evidently specifically identical both with Nos. 35285 and 36151 *b*. It has distinct mammillæ and well cupped terminal faces, but the hæmal ridge has practically disappeared.

Purchased, 1861.

36151 a. The centrum of a small anterior dorsal vertebra.

Purchased, 1861.

36151 b. (*Fig.*) The centrum of a later immature dorsal vertebra. Figured by Owen, *op. cit.* pl. vi. figs. 8–11, as *P. neocomiensis*. Length 0,034 (1·35 inches), height 0,042 (1·15 inches), width 0,046 (1·8 inches). The mammillæ are well developed. The type dorsal of *Cimoliosaurus neocomiensis* (p. 223) has flatter terminal faces, and a less distinct anterior overhang of the upper part of the centrum. The present specimen has a strong general resemblance to the dorsals of *C. oxoniensis*.

Purchased, 1861.

36151 c, d. Two similar specimens.

Purchased, 1861.

36151 e. A more imperfect dorsal centrum.

Purchased, 1861.

35343. The centrum of a smaller dorsal vertebra, in which the terminal mammillæ are very indistinct. *Purchased*, 1860.

35285 a. The centra of three dorsal vertebræ probably associated with No. 35285. The mammillæ are indistinct.
Purchased, 1859.

46378. The centrum of a similar dorsal vertebra.
Purchased, 1876.

35460. A similar specimen. *Purchased*, 1860.

R. 1304. The imperfect centrum of a similar dorsal vertebra; from the Gault of Folkestone, Kent. *No history.*

35284. The imperfect centrum of an anterior caudal vertebra. This specimen approximates to the larger caudal of *C. bernhardi* figured by Kiprijanoff in the 'Mém. Ac. Imp. St. Pétersbourg,' vol. xxx. art. 6, pl. iii. fig. 1, but has a small central mammilla. The later caudal represented in fig. 4 of the same plate as *Plesiosaurus neocomiensis* has similar characters. In all these specimens the chevron-facets are confined to the posterior border.
Purchased, 1859.

36151 x. (*Fig.*) Two small propodial bones (one imperfect), figured by Owen, *op. cit.* pl. vi. figs. 12, 13, as *P. neocomiensis*. There are no valid grounds for this reference.
Purchased, 1861.

Cimoliosaurus bernardi (Owen [1]).

Syn. *Plesiosaurus bernardi*, Owen [2].
Plesiosaurus ichthyospondylus, Seeley [3].
(?) *Plesiosaurus pachyomus*, Owen [4] (*in parte*).
(?) *Plesiosaurus balticus*, Schröder [5].

Imperfectly known; much larger than the preceding. Cervical and dorsal vertebræ comparatively short; the former with the terminal faces very deeply cupped, and widely bevelled at the edges; with the oblique zygapophysial ridge less strongly marked than in the preceding species. Dorsals without central mammillæ, and with bevelled edges to the terminal faces of the centra. In the cervicals the terminal faces of the centra are less elliptical than in other species. The type cervical vertebra (Owen, 'Cretaceous

[1] In Dixon's Geology of Sussex, 1st ed. p. 396 (1850).—*Plesiosaurus.*
[2] *Loc. cit.*
[3] Index to Aves &c. in Cambridge Museum, p. xvii (1869).
[4] Cretaceous Reptilia (Mon. Pal. Soc.), pt. i. pl. xx. (1851).
[5] Jahrb. preuss. geol. Landesanstalt for 1884, p. 297 (1885).

Reptilia,' pt. i. pl. xvii., 1851) is from the Chalk of Sussex; the specimens from the Cambridge Greensand have been separated by Seeley as *Plesiosaurus ichthyospondylus*, without any specific characters being given. The Russian specimens are from the "Osteolite," which is probably the equivalent of the Gault. It appears not improbable that the later cervical and "pectoral" vertebræ figured in the 'Cretaceous Reptilia,' pt. i. pl. xx. as *Plesiosaurus pachyomus* (which was founded upon an unfigured propodial) are referable to this species. *Plesiosaurus balticus* from the Chalk of Prussia was founded upon "pectoral" vertebræ and a propodial, the latter being of the type of *C. trochanterius*.

Hab. Europe (England, Russia [1], and Germany [2]).

The following specimens are from the Cambridge Greensand. It is probable that the greater number of the cervicals belong to a single individual, which was immature.

35295. (*Fig.*) The centrum of an anterior cervical vertebra. Figured by Owen in his 'Cretaceous Reptilia' (Mon. Pal. Soc.), suppl. iv. pl. iv. figs. 1–4 (1864). Length 0,031 (1·22 inches), height 0,035 (1·36 inches), width 0,036 (1·42 inches).
Purchased, 1859.

35295 a. (*Fig.*) The crushed centrum of an anterior cervical vertebra. Figured, *op. cit.* pl. iv. figs. 5, 6. *Purchased*, 1859.

35295 b. (*Fig.*) The centrum and left side of the neural arch of a larger and probably later cervical vertebra. Figured, *op. cit.* pl. iv. fig. 9. *Purchased*, 1859.

35295 c. (*Fig.*) The centrum of a somewhat crushed cervical vertebra. Figured, *op. cit.* pl. iv. figs. 7, 8, and pl. v. fig. 7.
Purchased, 1859.

35295 d. (*Fig.*) A cervical vertebra, wanting the ribs, zygapophyses, and neural spine. Figured, *op. cit.* pl. iv. fig. 10, and pl. v. fig. 1. *Purchased*, 1859.

35295 e. (*Fig.*) A very similar specimen showing the zygapophyses of the left side. Figured, *op. cit.* pl. iv. fig. 11, and pl. v. figs. 2 and 6. The slight curvature of the zygapophysial articulations characteristic of the group is well shown.
Purchased, 1859.

[1] Kiprijanoff, Mém. Ac. Imp. St. Pétersbourg, vol. xxx. art. 6, p. 5.
[2] Schröder, Jahrb. preuss. geol. Landesanstalt for 1884, pp. 297, 315.

35295 f. (*Fig.*) A considerably larger imperfect cervical vertebra. Figured, *op. cit.* pl. v. figs. 3–5. The ribs and arch are anchylosed to the centrum. *Purchased*, 1859.

35295 g. A cervical vertebra, wanting the neural spine and ribs. Length of centrum 0,040 (1·55 inches), height 0,051 (2·0 inches), width 0,051 (2·0 inches). *Purchased*, 1859.

35295 h. Four centra of cervical vertebræ. One specimen has the pedicles of the arch attached. *Purchased*, 1859.

36150. The neural arch and spine of a large cervical vertebra. In contour this specimen closely resembles the arch of the cervical of *C. valdensis*, No. R. 609 (p. 189). *Purchased*, 1861.

35307. Three imperfect centra of associated dorsal vertebræ, agreeing closely with the following specimens. *Purchased*, 1859.

36150 a. Seven imperfect associated centra of dorsal vertebræ. These specimens agree in relative size with the large cervical, No. 35295 *b*; the dimensions of the best preserved specimen being:—length 0,054 (2·15 inches), height 0,069 (2·7 inches), width 0,076 (3·0 inches). The terminal faces are distinctly cupped; and the whole contour of these specimens is very similar to that of the dorsals of *C. eurymerus*, No. 46484 (p. 207). *Purchased*, 1861.

The following specimens indicate the existence of this or a closely allied species at the period of the Lower Greensand; their resemblance to the Upper Cretaceous specimens and the absence of vertebræ of similar type in the Kimeridge Clay indicate that these specimens were not derived from the latter deposit.

42102. The centrum of an anterior cervical vertebra; from the Neocomian bone-bed of Potton, Bedfordshire. This specimen presents no characters by which it can be specifically distinguished from the early cervicals from the Cambridge Greensand, exhibiting the same large costal facets and the prominent hæmal ridge. *Purchased*, 1870.

40456. The centrum of a later cervical vertebra; from Potton. *Purchased*, 1870.

Cimoliosaurus tenuis (Hector [1]).

Syn. *Polycotylus tenuis*, Hector [2].

Very imperfectly known, being founded upon cervical vertebræ and the following specimen; it probably belongs to the present group, as the vertebræ are deeply cupped.

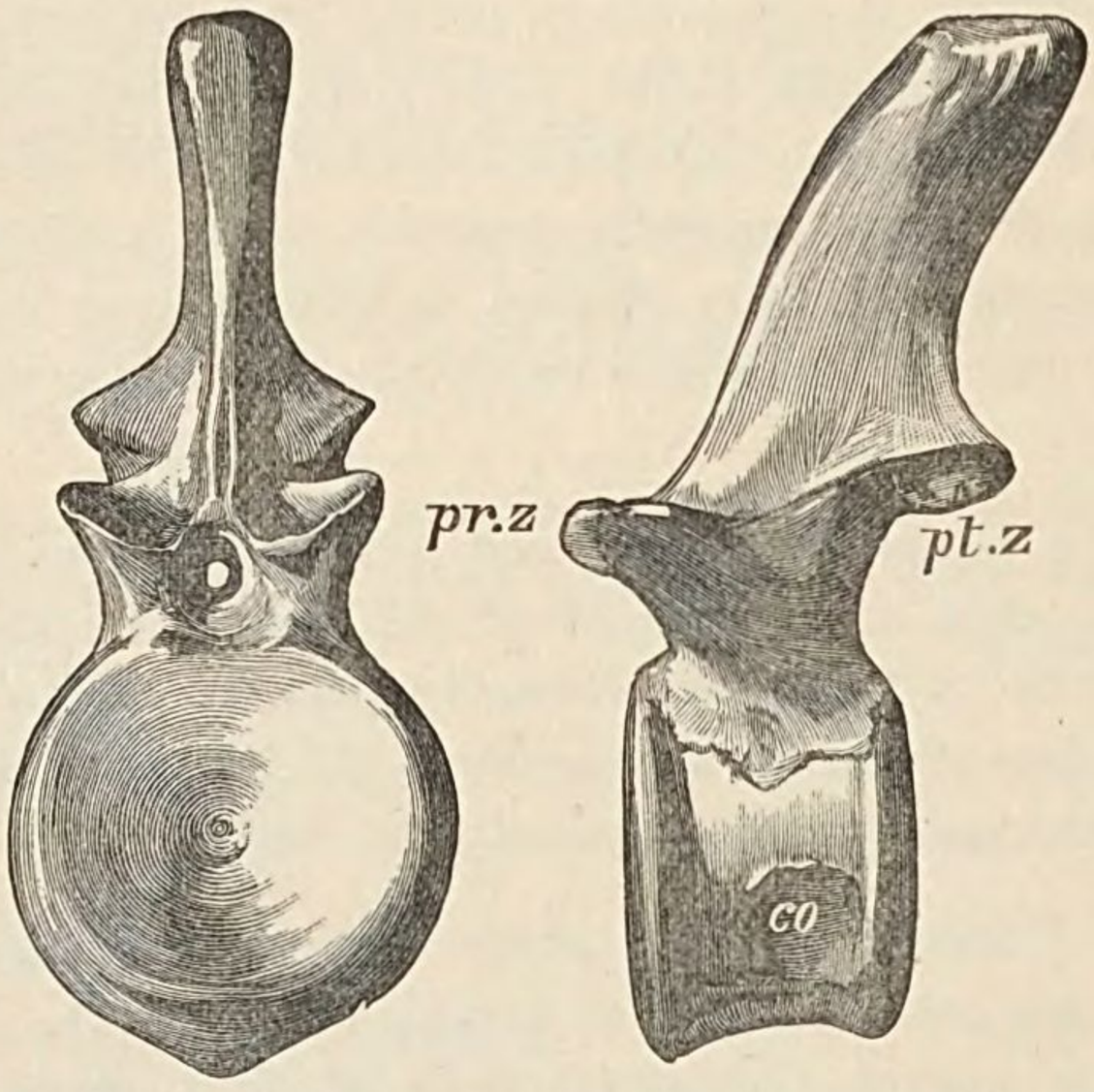
Hab. New Zealand.

R. 838. (*Fig.*) An imperfect propodial bone (? humerus); from the Cretaceous of Amuri Bluff, North Island, New Zealand. One of the type specimens; figured by Hector in the 'Trans. N. Zealand Inst.' vol. vi. pl. xxvii. fig. B.
By exchange with the Wellington Museum, 1880.

Cimoliosaurus valdensis, Lydekker (n. sp.).

Of very small size. Both the cervicals and dorsals very short; the terminal faces of the former less deeply cupped than in *C. bernardi*, and those of the latter without a mammilla in the centra; arches of cervical vertebræ with the oblique zygapophysial ridge indistinct.

Fig. 61.



Cimoliosaurus valdensis.—Anterior and left lateral aspects of a cervical vertebra; from the Wealden of Hastings. $\frac{2}{3}$. *pr.z*, prezygapophysis; *pt.z*, postzygapophysis; *co*, costal facet.

The small dimensions of this species, coupled with the freshwater character of the beds in which it occurs, indicate the probability of

[1] Trans. N. Zealand Inst. vol. vi. p. 345 (1874). [2] *Loc. cit.*

fluviatile or estuarine habits. The unnamed vertebra from the German Wealden figured by Koken in the 'Pal. Abhandl.' vol. iii. pt. v. pl. v. fig. 4, belongs to the present species.

Hab. Europe (England and Germany).

R. 609. (*Fig.*) A large series of cervical, dorsal, and caudal vertebræ, mostly wanting the neural arches, of which the greater number belong to a single individual; from the Wadhurst Clay (Lower Wealden) of Hastings, Sussex. The types. A nearly entire late cervical is figured in the accompanying woodcut; the arch is anchylosed to the centrum, but the ribs were loose and have been lost. The dimensions of the centrum are:—length 0,023 (0·9 inch), height 0,032 (1·26 inches), width 0,035 (1·37 inches); the height from the base of the neural canal to the summit of the spine being 0,047 (1·85 inches). The lowness of the spine and the cupped centrum at once distinguish this specimen from the cervical of *C. limnophilus*, No. 2429 (p. 225). In one of the dorsals (No. R. 609 *a*) the dimensions of the centrum are:—length 0,024 (0·95 inch), height 0,033 (1·33 inches), width 0,044 (1·75 inches). A series of similar vertebræ from Hastings is preserved in the Museum of Practical Geology, Jermyn Street.

Dawson Collection. Purchased, 1884.

36549. A nearly entire later cervical vertebra of slightly larger size than the figured cervical of the preceding series; from the Wealden of Cuckfield, Sussex. In this specimen both the arch and ribs are completely anchylosed to the centrum, with obliteration of the sutures. The general contour is very similar to that of the cervicals of *C. bernardi*.

Mantell Collection. Purchased, 1853.

2439. The centrum and base of the arch of a dorsal vertebra closely resembling No. R. 609 *a*; from Cuckfield.

Mantell Collection. Purchased, 1838.

2434. The centrum of an anterior caudal vertebra probably referable to this species; from Cuckfield. *Mantell Collection.*

40549. The left humerus imperfect distally; from Cuckfield. The general characters of the proximal extremity resemble those of the humerus of *C. trochanterius*, but the proximal extremity of the trochanter is less developed.

Mantell Collection. Purchased, 1853.

R. 609 b. The right femur; from Hastings. Associated with the type vertebræ. Length 0,170 (6·7 inches), width at distal extremity 0,075 (2·95 inches). *Dawson Collection.*

Cimoliosaurus trochanterius (Owen [1]).

Syn. *Plesiosaurus trochanterius*, Owen [2].
Pliosaurus trochanterius, Owen [3].
Including:—
Plesiosaurus affinis, Owen [4].
Plesiosaurus manseli, Hulke [5].
Syn. *Muræosaurus manseli*, Sauvage [6].
Plesiosaurus megadirus, Seeley [7].
Syn. *Plesiosaurus macrodirus*, Seeley [8].
Colymbosaurus megadirus, Seeley [9].
Plesiosaurus brachyspondylus, Phillips [10] (*non* Owen).
Syn. *Muræosaurus brachyspondylus*, Sauvage [11].
Plesiosaurus validus, Phillips [12].

Of very large size. Cervical vertebræ probably about 35 in number [13]; their centra, except in the anterior region, moderately short, with well-cupped terminal faces, and with or without a distinct lateral depression; and the arches without oblique zygapophysial ridges. Humerus (fig. 62) relatively long, with the distal expansion chiefly confined to the postaxial border, and (according to Hulke) articulating distally with three bones; the radius short, and the ulna pentagonal and not greatly expanded transversely. In the humerus and femur the preaxial roughened surface of the distal extremity does not extend nearly as high up as the postaxial one. The relations of the forms described under the above-mentioned names have been discussed by the writer in the 'Geol. Mag.' dec. 3, vol. v. pp. 353–356 (1888). The species was founded upon the undermentioned femur, No. 31787, which cannot apparently be specifically distinguished from the corresponding bone of the type

[1] Rep. Brit. Assoc. for 1839, p. 85 (1840).—*Plesiosaurus.*
[2] *Loc. cit.* [3] *Ibid.* for 1841, p. 64 (1842).
[4] *Ibid.* for 1839, p. 86 (1840).
[5] Quart. Journ. Geol. Soc. vol. xxvi. p. 612 (1870).
[6] Ann. Sci. Nat., Zool. sér. 6, vol. viii. art. 6, p. 32 (1879).
[7] Index to Aves &c. in Cambridge Museum, p. xx (1869). Description insufficient.
[8] *Ibid.* p. 143.—*Errorim.*
[9] Quart. Journ. Geol. Soc. vol. xxx. pp. 445, 447 (1874).
[10] Geology of Oxford, p. 368 (1871).
[11] *Op. cit.* p. 33. [12] *Op. cit.* p. 370.
[13] Seeley gives the number of cervicals in *P. megadirus* as 42, but this seems to include "pectorals."

skeleton of *Plesiosaurus manseli*; this specimen might, indeed, be referable to *C. brachistospondylus*, but since the latter appears to be a comparatively rare form it is more probable that the commoner type of vertebræ were associated with this humerus. The vertebræ described under the names of *Plesiosaurus manseli* and *P. validus* are characterized by a more or less distinct lateral depression on the centra of the cervical vertebræ, while in those described as *P. brachyspondylus* and *P. megadirus* such depressions are absent. *P. validus* appears, however, to be somewhat intermediate in this respect between *P. manseli* and *P. brachyspondylus*; and since similar variations occur in regard to the depth and form of the cupping of the terminal faces of the cervical vertebræ it seems impossible to separate these two types of structure without making at least three undefinable species. The variations in this respect appear, indeed, to be local racial characters, the northern race having lost the lateral depression. Thus in the one known skeleton from Dorsetshire these depressions are very marked (*P. manseli*); in the intermediate Oxfordshire area we meet with one form (*P. validus*) in which these depressions are less marked, and another (*P. brachyspondylus*) in which they are absent; while in the Cambridgeshire type (*P. megadirus*) these depressions are invariably wanting.

The difference in the size of the type femur and that of the skeleton of *P. manseli* can scarcely be taken as a specific character, since it is evident that in species of this size a considerable limit must be allowed for sexual and individual variations in this respect. The genus *Colymbosaurus* was founded upon the evidence of a detached pectoral girdle from Ely (fig. 59), which was identified by its describer with *P. megadirus*; *P. manseli* being referred by the same writer to a subgenus of *Murænosaurus*. In the 'Rep. Brit. Assoc.' for 1841, p. 64, *Plesiosaurus trochanterius* was transferred by its founder to *Pliosaurus*; the skull subsequently described under that name is catalogued in Pt. i. p. 104 under the Crocodilian genus *Machimosaurus*.

Hab. Europe (England and France).

42496. An associated series of 86 vertebræ, mostly wanting the neural arches; from the Kimeridge Clay (Upper Jurassic) of Kimeridge Bay, Dorsetshire. These specimens are described by Hulke in the 'Quart. Journ. Geol. Soc.' vol. xxvi. pp. 613–615, and together with the undermentioned coracoids and limb-bones are the types of *Plesiosaurus manseli*. Twenty-eight true cervicals now remain, but several are missing behind the axis, and there

was evidently a considerable gap between the centra marked 12 and 13; one vertebra (42496 *a*) having been found since the series was described, which is evidently one of the missing specimens from this part. The first 12 remaining vertebræ are somewhat distorted and have lost the greater portion of their arches. In the ninth the dimensions of the centrum are:—length 0,053 (2·1 inches), height 0,056 (2·2 inches), and width 0,062 (2·4 inches). In the later cervicals the centrum becomes relatively shorter; the lateral and hæmal depressions being well marked. The dimensions of No. 42496 *a*, which is probably about the 18th of the complete series, are:—length 0,048 (1·9 inches), height 0,053 (2·1 inches), width 0,067 (2·65 inches). Still later in the cervical series (42496 *c*) the lateral depressions become less marked, and the hæmal depressions totally disappear, so that there is a blunt ridge between the two foramina on this surface. The dimensions of this centrum are:—length 0,058 (2·3 inches), height 0,081 (3·2 inches), width 0,098 (3·9 inches). Comparisons of some of the vertebræ are made below. *Presented by J. C. Mansel-Pleydell, Esq.*, 1870.

41802 x. The third (?) cervical vertebra, wanting the greater portion of the arch; from the Kimeridge Clay of Ely, Cambridgeshire. The dimensions of the centrum are:—length 0,029 (1·15 inches), height 0,030 (1·18 inches), width 0,036 (1·4 inches). The corresponding vertebra is missing in the preceding series, but the centrum of this specimen agrees in size with that of the axis of the latter. The conjoint atlas and axis of the type skeleton of *P. megadirus* figured by Barrett in the 'Ann. Mag. Nat. Hist.' 1858, vol. ii. pl. xiii. fig. 2, also agree precisely with the corresponding element in No. 42496. *Purchased*, 1869.

R. 1256. Casts of the centra of the 10th and 22nd cervical vertebræ. The originals belong to the vertebral column on which *Plesiosaurus megadirus* was founded, which was obtained from the Kimeridge Clay of Haddenham, Cambridgeshire, and is preserved in the Woodwardian Museum at Cambridge. The dimensions of the 10th are:—length 0,041 (1·60 inches), height 0,042 (1·65 inches), width 0,052 (2·5 inches); and those of the 22nd:—length 0,054 (2·13 inches), height 0,063 (2·48 inches), width 0,076 (2·93 inches). The 10th closely resembles the early cervicals

of No. 42496. The 22nd corresponds nearly to the one marked 13 (42496 *b*) in No. 42496, which is probably the 23rd of the full series. The present specimen differs from the latter in the absence of the distinct lateral depression, but has the same deeply cupped terminal faces, in which the depression occupies the whole of the surface. The posterior face has the same bevelled inferior border, but the anterior face is slightly less elliptical. Compared with No. R. 1286 (*infrà*), which is probably about the 20th of the series, this specimen differs by the absence of the lateral depression, and also by the circumstance that in the terminal faces of the latter the depression is confined to the central region; both have the same approximation to a circular form in the contour of the anterior face. No. R. 1286 differs both from the present specimen and No. 42496 *b* in the bevelling of the lower border of the anterior face, but in other respects is somewhat intermediate between the two; its lateral depression being less deep and more widely defined than in No. 42496 *b*.

Made in the Museum, 1888.

R. 1286. Cast of an imperfect middle (? 20th) cervical vertebra. The original is one of a series of cervicals obtained from the Kimeridge Clay of Cumnor-Hurst, near Oxford, and preserved in the Oxford Museum, that series being one of the types of *Plesiosaurus validus*. The original of the present specimen is figured on a scale of $\frac{1}{5}$, with considerable restoration, on p. 371 of Phillips's 'Geology of Oxford'; the rounded contour of the neural canal given in the figure being due to an incorrect restoration of the neural arch, which has now been placed in its proper position. The chief characters of this specimen have been already noticed under the preceding entry.

Made in the Museum, 1888.

31924. A large posterior cervical vertebra wanting the spine of the neural arch and the extremities of the ribs; from Shotover. Length of centrum 0,054 (2·15 inches), height 0,078 (3·1 inches), width 0,099 (3·9 inches). This specimen closely resembles the cervical figured by Phillips on p. 368.

Purchased.

31914. A rather smaller and somewhat earlier cervical vertebra; from Shotover. The processes are imperfect.

Purchased.

41802. A nearly entire posterior cervical vertebra, corresponding approximately in position with the preceding specimen; from the Kimeridge Clay of Ely, Cambridgeshire. This is a typical example of the so-called *Plesiosaurus brachyspondylus* or *megadirus*. *Purchased*, 1869.

41802 a. A late cervical vertebra associated with the preceding, wanting the neural spine and the extremities of the ribs; from Ely. The vertically elongated contour of the neural canal and its deeply excavated base are well shown. Of the centrum the length is 0,054 (2·15 inches), the height 0,067 (2·65 inches), and the width 0,085 (3·35 inches). *Purchased*, 1869.

R. 1257. An imperfect cervical vertebra closely resembling the preceding; from Ely. *Presented by R. Lydekker, Esq.*, 1888.

32776. An imperfect late cervical vertebra; from the Kimeridge Clay of Boulogne, France. This specimen closely resembles No. 41802 *a*. The summit of the neural spine and both the ribs are broken off, and the hæmal ridge is prominent. *Purchased.*

153. A posterior cervical vertebra; from the Kimeridge Clay of Somersetshire. This specimen is somewhat obscured by matrix and the processes are imperfect, the ridge between the hæmal foramina being very prominent. *Mantell Collection. Purchased*, 1838.

R. 274. A very similar, but more imperfect specimen; probably from Shotover. This specimen has very deep terminal cups. *Egerton Collection. Purchased*, 1882.

31921. The imperfect centrum of a "pectoral" vertebra; from Shotover. This specimen approximates to No. 42496 *e*, but is somewhat later in the series. The hæmal ridge has become very broad and indistinct. *Purchased*, 1859.

41776. The centrum and base of the arch of a small vertebra, probably from the "pectoral" region, and provisionally referred to this species; from the Kimeridge Clay of Weymouth, Dorsetshire. *Purchased*, 1869.

46475. A very similar but somewhat longer centrum; from the Kimeridge Clay of Devizes, Wiltshire. *Cunnington Collection. Purchased*, 1875.

41802 e. An imperfect vertebra, probably belonging to the pectoral region ; from Ely. *Purchased*, 1869.

41802 b. The imperfect centrum and base of the arch of an anterior dorsal vertebra ; from Ely. This specimen is almost indistinguishable from No. 42496 *f*. *Purchased*, 1869.

24684 a. The centrum and base of the arch of an anterior dorsal vertebra ; from the Kimeridge Clay of Wootton-Bassett, Wiltshire. *Cunnington Collection*. *Purchased*, 1849.

R. 258. A dorsal vertebra wanting the neural spine and one transverse process ; from Shotover. Length of centrum 0,057 (2·25 inches), height 0,081 (3·2 inches), width 0,088 (3·46 inches). *Egerton Collection*.

41802 c. A very similar imperfect dorsal vertebra ; from Ely. *Purchased*, 1869.

47421. An anterior dorsal vertebra, wanting some of the processes of the neural arch ; from Ely. Length of centrum 0,064 (2·5 inches), height 0,092 (3·6 inches), width 0,094 (3·7 inches). This specimen closely resembles the one mentioned as No. 12 on p. 370 of Phillips's 'Geology of Oxford' ; and is also very similar to No. 42496 *f*. *Sharp Collection*. *Purchased*, 1876.

41802 d. A very similar specimen ; from Ely. The neural spine and the right transverse process are wanting. The excavation of the base of the neural canal is shown. *Purchased*, 1869.

24804. An imperfect dorsal vertebra closely resembling the preceding ; from the Kimeridge Clay of Pottern, Wiltshire. *Cunnington Collection*.

24804 a. The centrum of a rather larger dorsal vertebra, probably associated with the preceding ; from Pottern. Length 0,063 (2·5 inches), height 0,094 (3·7 inches), width 0,106 (4·15 inches) ; these dimensions being almost identical with those of the specimen described by Phillips on p. 369 as No. 1 (*P. brachyspondylus*). *Cunnington Collection*.

R. 276. A very large posterior dorsal vertebra, with the arch imperfect ; from the Kimeridge Clay of Wheatley, Oxfordshire. Length of centrum 0,078 (3·1 inches), height 0,104 (4·5 inches), width 0,124 (4·9 inches). *Egerton Collection*.

R. 276 a. A similar but more imperfect specimen; from Wheatley.
Egerton Collection.

31911. A posterior dorsal vertebra, with the arch imperfect; from Shotover. In this specimen, which is as large as the preceding, the depression of the base of the neural canal, so conspicuous in the anterior dorsals, has almost disappeared. The centrum, as in the preceding specimen, has the terminal faces transversely elliptical, instead of nearly circular, as in No. 41802 *d*. *Purchased*, 1859.

31922. A posterior dorsal vertebra, somewhat imperfect; from Shotover. *Purchased*, 1859.

47878. An imperfect posterior dorsal vertebra agreeing very closely with the preceding; from Shotover. The post-zygapophyses are well shown.
Presented by the Hon. R. Marsham, 1877.

47878 a. Two still more imperfect dorsal vertebræ, associated with the last. *Presented by the Hon. R. Marsham*, 1877.

32777. An imperfect vertebra, probably belonging to the lumbar region; from Boulogne. *Purchased.*

31913. The centrum of a smaller vertebra, probably from the lumbar region; from Shotover. This specimen closely resembles No. 42496 *g*, and has its terminal faces elliptical.
Purchased, 1859.

31904. A similar and probably associated centrum; from Shotover.
Purchased, 1859.

47328. A middle caudal vertebra, probably belonging to this species; from the Kimeridge Clay of Swindon, Wiltshire.
Presented by the Directors of the Swindon Brick and Tile Company, 1876.

R. 1287. Cast of the centrum of an anterior caudal vertebra. The original is from the Kimeridge Clay of Baldon, Oxfordshire; and, together with eight associated caudals and a few cervicals, is preserved in the Oxford Museum. This specimen is figured by Phillips on p. 372, as one of the types of *P. validus*. It is absolutely indistinguishable from an anterior caudal of No. 42496, marked *g*. Length 0,057 (2·25 inches), height 0,082 (3·25 inches), width 0,099 (3·9 inches). *Made in the Museum*, 1888.

42496 a. (*Fig.*) The anterior portion of the united coracoids, associated with the vertebræ No. 42496. Figured by Hulke in the 'Quart. Journ. Geol. Soc.' vol. xxvi. pl. xli. figs. 5, 6. A fractured surface on the ventral side of the anterior border indicates where the median longitudinal bar was attached. The interval between the posterior extremities of the two glenoid cavities is 0,520 (20·5 inches).

Presented by J. C. Mansel-Pleydell, Esq., 1870.

40106. (*Fig.*) The left humerus, with the radius, ulna, and pisiform in apposition; from Kimeridge Bay. One of the types of *P. manseli*, associated with the vertebræ No. 42496. Figured by Hulke in the 'Quart. Journ. Geol. Soc.' vol. xxvi. pl. xli. figs. 3, 4, and also in the 'Proc. Geol. Soc.' for 1883, p. 52, fig. 7, as the femur. Judging, however, from No. 46479 and the examples of *C. eurymerus* in the collection of A. N. Leeds, Esq., this specimen must be referred to the pectoral limb. The length is 0,519 (20·5 inches), and the transverse diameter of the distal extremity 0,340 (12 inches). Hulke regards the bone here termed the ulna as the intermedium. Specimens from Ely, in the collection of M. Fischer, Esq., of that town, confirm Hulke's arrangement of the three distal bones. *Presented by J. C. Mansel-Pleydell, Esq.*, 1870.

40107. The right humerus, wanting the distal extremity, associated with the preceding.

Presented by J. C. Mansel-Pleydell, Esq., 1870.

46479. (*Fig.*) A smaller right humerus of similar type, and belonging either to an immature individual of this or the next species, or to a nearly allied smaller species; from the Kimeridge Clay, locality unknown. Length 0,460 (16 inches), transverse diameter of distal extremity 0,287 (11·5 inches). This specimen (fig. 62) closely resembles the humerus figured by Phillips in his 'Geology of Oxford,' p. 365 (reproduced in fig. 63), of which the length is 18 inches. The latter specimen tends, therefore, in point of size to connect the present one with this species. The inequality in the height of the rough cartilaginous surface on the distal borders is well shown. Hulke's restoration of the postaxial border of No. 40106 is somewhat different from the corresponding portion of this specimen.

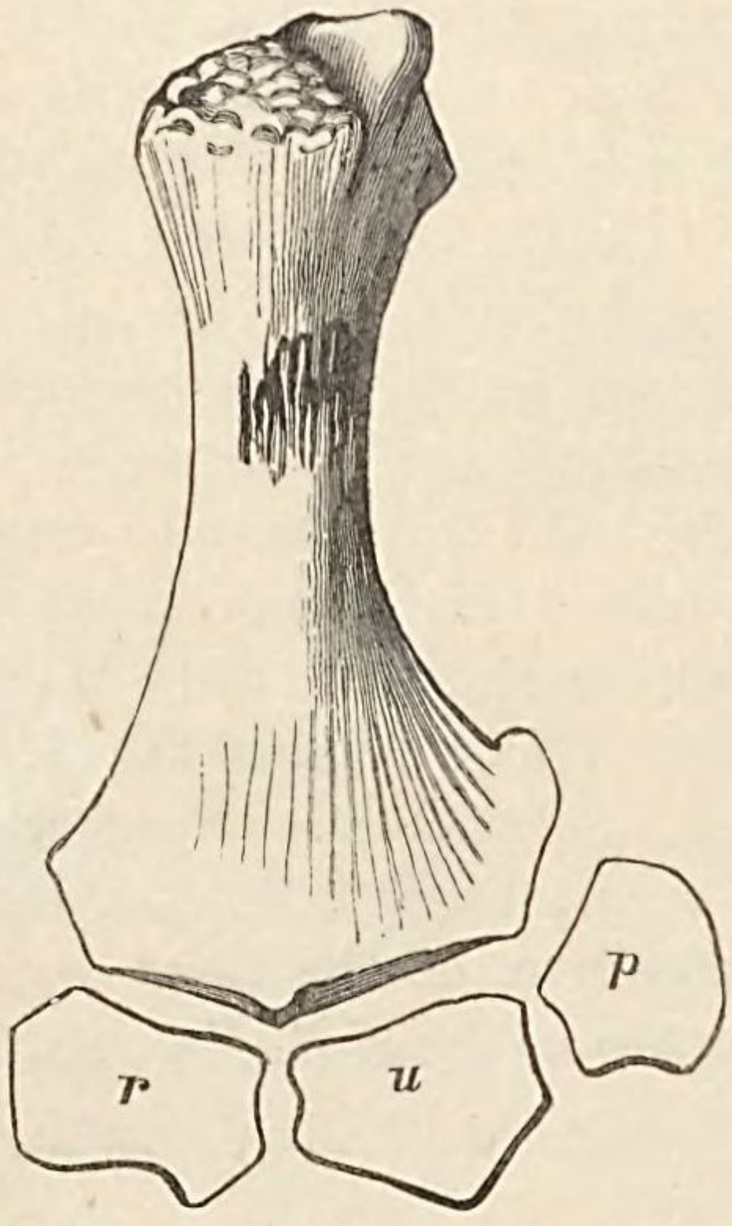
Cunnington Collection. Purchased, 1875.

46796 c. A small right humerus probably belonging to a young

individual of this or the next species; from the Kimeridge Clay of Foxhangers. Length 0,266 (10·5 inches), width of distal extremity 0,190 (7·5 inches). This specimen, which shows evident signs of its immaturity, accords closely with the description of the type humerus of *Plesiosaurus affinis*, but is 1·5 inches longer.

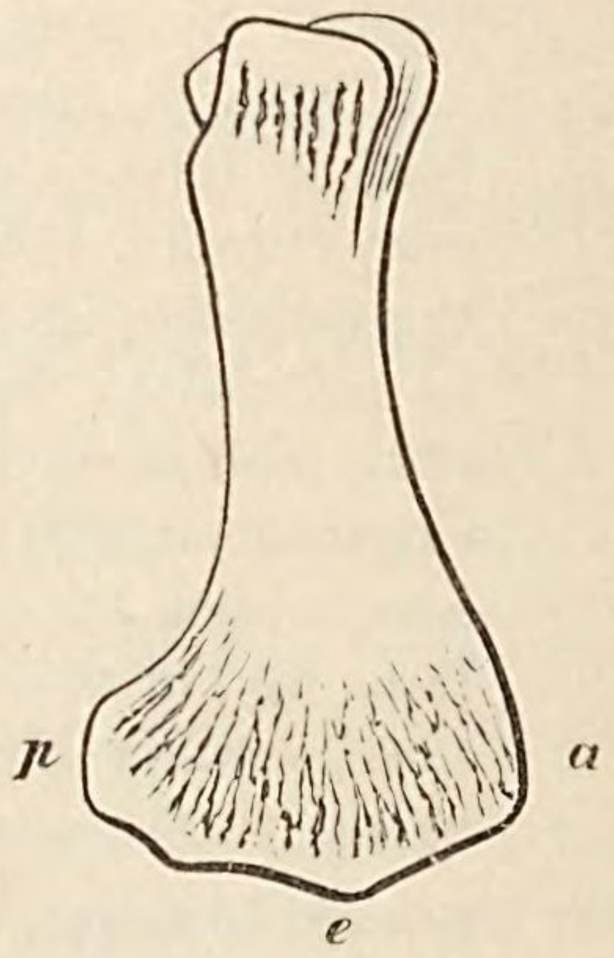
Cunnington Coll.

Fig. 62.



Cimoliosaurus (*cf.*) *trochanterius.*—Ventral aspect of the right humerus, with the radius (*r*), ulna (*u*), and pisiform (*p*); from the Kimeridge Clay. $\frac{1}{8}$. The contour of the three distal bones is somewhat conjectural, and is given from Hulke's figure.

Fig. 63.



Cimoliosaurus (*cf.*) *trochanterius.*—Dorsal aspect of the right humerus; from the Kimeridge Clay of Oxfordshire. $\frac{1}{10}$. *a*, preaxial; *p*, postaxial border; *e*, division between radial and ulnar facets. (*After Phillips.*)

31787. (*Fig.*) The right femur of a large individual, with the postaxial border of the distal extremity imperfect; from the Kimeridge Clay of Wiltshire. The type specimen; originally in the collection of the Earl of Enniskillen. Described by Owen in the 'Rep. Brit. Assoc.' for 1839, p. 85; noticed by Hulke in the 'Quart. Journ. Geol. Soc.' vol. xxvi. p. 620 (the specimen being then labelled *Plesiosaurus brachydirus*), where it is compared to No. 40106; and figured by Phillips in his 'Geology of Oxford,' p. 364, as a humerus. Length 0,680 (24 inches), circumference of proximal extremity 0,528 (19 inches), diameter of

remaining portion of the distal extremity 0,254 (10 inches). The specimen has, however, been broken and mended with plaster, and the length is probably at least one inch too long. On p. 316 of Phillips's 'Geology of Oxford' it is stated, on the authority of the Earl of Enniskillen, that this specimen was obtained from the Oxford Clay; but this is in all probability incorrect, since no similar femora are known from that horizon, nor are there vertebræ of sufficient size to have belonged to such a specimen. In Owen's description the locality is erroneously given as Shotover. Owing to the incorrect labelling of this specimen it was regarded by Hulke as the type of *Pliosaurus brachydirus*. *Purchased*, 1859.

40107 a. (*Fig.*) A somewhat smaller left femur, associated with No. 40106. Figured by Hulke, in the 'Quart. Journ. Geol. Soc.' vol. xxvi. pl. xli. figs. 1, 2, as a humerus. The postaxial border of the distal extremity is imperfect. The length is 0,508 (20 inches), or slightly less than that of the associated humerus.

Presented by J. C. Mansel-Pleydell, Esq., 1870.

40107 b. The distal extremity of the right femur of the same individual, in a somewhat imperfect condition.

Presented by J. C. Mansel-Pleydell, Esq., 1870.

40108 a. A series of distal bones of the paddles, probably associated with the preceding.

Presented by J. C. Mansel-Pleydell, Esq., 1870.

31795. The right femur, with the postaxial portion of the distal expansion wanting; from the Kimeridge Clay of Shotover. Noticed by Hulke in the 'Quart. Journ. Geol. Soc.' vol. xxvi. p. 620, where, owing to its labelling, it is stated to be the type of the species, which, however, is not the case. Its resemblance to No. 40107 *a*, which is slightly larger, is pointed out in that notice.

Purchased, 1859.

11900. The distal extremity of a large humerus or femur, not improbably belonging to this species; from the Kimeridge Clay of Newport-Pagnall, Buckinghamshire. This specimen was presented in 1835 to Dr. Mantell by the Rev. John Prettyman. *Mantell Collection.* *Purchased*, 1838.

The following specimens are from the Neocomian bone-bed of Potton, Bedfordshire, and were doubtless derived from the Kimeridge Clay.

42089. A very early (? third) cervical vertebra, wanting the greater part of the neural arch and ribs. This specimen is indistinguishable from the Ely example No. 41802 *x*.
Purchased, 1870.

40444 a. The centrum of a middle cervical vertebra.
Purchased, 1867.

40444 b. The centrum of a somewhat later cervical vertebra. In general characters this specimen comes nearest to the cervical described as *Plesiosaurus validus*, No. R. 1286.
Purchased, 1867.

40444 c. An early posterior cervical vertebra. Closely resembles the Ely specimen No. 41802. *Purchased*, 1867.

Cimoliosaurus brachistospondylus (Hulke [1]).

Syn. *Plesiosaurus brachistospondylus*, Hulke [2].

As large as the preceding species, but with the centra of the vertebræ much shorter. This species was founded upon the undermentioned dorsal vertebræ [3] (No. 45869). The cervicals described below differ from those of *C. trochanterius* in their relatively shorter centra, and the presumption, therefore, is that they should be referred to this species.

Hab. Europe (England).

42089. An imperfect anterior cervical vertebra ; from the Neocomian bone-bed of Potton, Bedfordshire ; derived from the Kimeridge Clay. This specimen is relatively much shorter than the anterior cervicals of *C. trochanterius*, the dimensions of the centrum being :—length 0,035 (1·36 inches), height 0,033 (1·3 inches), width 0,045 (1·77 inches).
Purchased, 1870.

40444. A somewhat later anterior cervical vertebra, in an imperfect condition ; from Potton. *Purchased*, 1867.

46448. A still later imperfect anterior cervical vertebra ; from Potton. *Purchased*, 1875.

[1] Quart. Journ. Geol. Soc. vol. xxvi. p. 611 (1870).—*Plesiosaurus.*

[2] *Loc. cit.*

[3] In the ' Geol. Mag.' dec. 3, vol. v. p. 354, the writer suggested that the shortness of these vertebræ might be due to pressure, a view which is not supported by subsequent observations.

42032. An imperfect early middle cervical vertebra; from Potton. The dimensions of the centrum are:—length 0,042 (1·65 inches), height 0,055 (2·15 inches), width 0,070 (2·75 inches). The same dimensions in a cervical of *C. trochanterius* (No. 42496 *a*) corresponding approximately in serial position with the present specimen being:—length 0,048 (1·88 inches), height 0,053 (2·1 inches), width 0,067 (1·64 inches). *Purchased*, 1870.

31902. An imperfect cervical vertebra agreeing very closely with the preceding specimen; from the Kimeridge Clay of Shotover, near Oxford. The dimensions of the centrum are:—length 0,041 (1·6 inches), height 0,052 (2·05 inches), width 0,070 (2·74 inches). *Purchased*, 1859.

31907. A more imperfect and somewhat later cervical vertebra, apparently associated with the preceding; from Shotover. *Purchased*, 1859.

42032 a. A somewhat later cervical vertebra, in an imperfect and much rolled condition; from Potton. *Purchased*, 1870.

R. 257. An immature cervical centrum not improbably belonging to the hinder part of the neck of the present form; from Shotover. The dimensions are:—length 0,041 (1·6 inches), height 0,056 (2·2 inches), width 0,076 (3 inches).
Egerton Collection. Purchased, 1882.

42099. A much smaller immature cervical centrum of similar type; from Potton. *Purchased*, 1870.

41905. A "pectoral" or lumbar vertebra; from the Kimeridge Clay of Kimeridge Bay, Dorsetshire. The dimensions of the centrum are:—length 0,055 (2·16 inches), height 0·100 (3·94 inches), width 0,113 (4·45 inches).
Presented by J. C. Mansel-Pleydell, Esq., 1870.

31906. The centrum and part of the arch of a dorsal vertebra; from Shotover. The dimensions of the centrum are:—length 0,043 (1·7 inches), height 0,100 (3·94 inches), width 0,105 (4·14 inches). *Purchased*, 1859.

45869. (*Fig.*) A slab in three fragments containing six dorsal vertebræ, portions of ribs, and some distal limb-bones; from Kimeridge Bay. The types; three of the vertebræ are figured by Hulke in the 'Quart. Journ. Geol. Soc.' vol. xxvi. pl. xli. figs. 7–9. The contour of the terminal faces of these vertebræ agrees precisely with that of several of the

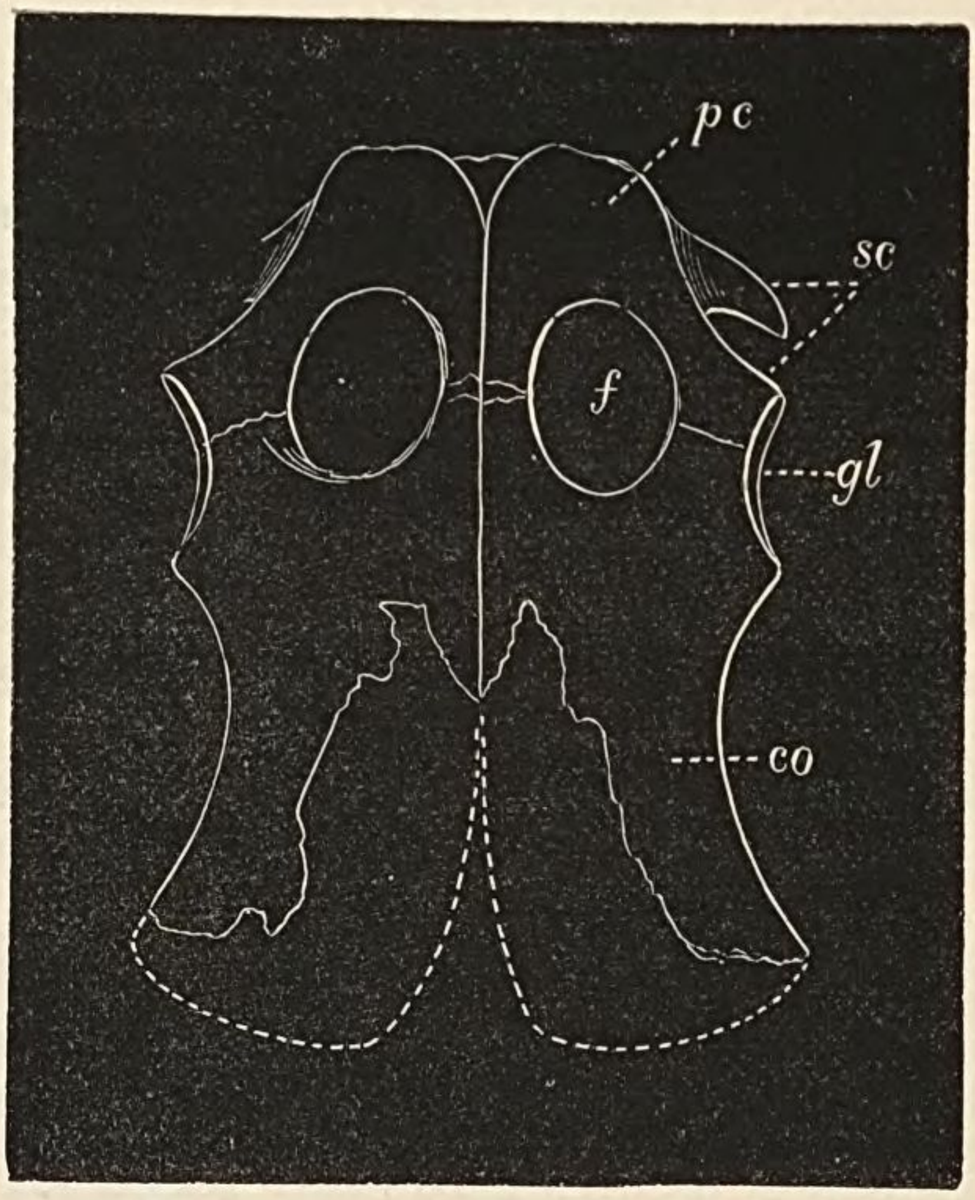
dorsals of *C. trochanterius*; the dimensions of one of the centra are:—length 0,033 (1·3 inches), height 0,097 (3·8 inches), width 0,112 (4·4 inches).

Presented by J. C. Mansel-Pleydell, Esq., 1874.

Specimens which may belong to either of the two preceding species, or to C. truncatus (*infrà*).

R. 735. The imperfect left scapula of a very large individual; from the Kimeridge Clay of Kimeridge Bay. The extreme length is 0,560 (22·1 inches). This specimen accords closely with the imperfect scapulæ from Shotover, figured by Phillips, *op. cit.* p. 377, diagram 177, as ischia, the

Fig. 64.



Cimoliosaurus (*cf.*) *trochanterius*.—Ventral aspect of the pelvic girdle; from the Kimeridge Clay of Kimeridge Bay. About $\frac{1}{10}$. *sc*, scapula; *pc*, ventral (precoracoidal) plate of do.; *f*, scapulo-coracoidal-foramen; *gl*, glenoid cavity; *co*, coracoid. (From the 'Proc. Geol. Soc.')

view being taken from the ventral aspect. The present specimen would indicate an individual of somewhat larger size than the type of *Plesiosaurus manseli*. The contour of this specimen is very similar to that of the corresponding element of the next specimen, and is totally different from that of *Pliosaurus*.

Presented by J. C. Mansel-Pleydell, Esq., 1886.

46833. (*Fig.*) The nearly entire pectoral girdle of a smaller individual; from Kimeridge Bay. Described and figured by Hulke in the 'Proc. Geol. Soc.' for 1883, pp. 59–60, fig. 16, the figure being reproduced in the accompanying woodcut. It is believed that this specimen is the one on which the pectoral girdle figured by Owen in the 'Quart. Journ. Geol. Soc.' vol. xxxix. p. 135, fig. 2, as that of *Pliosaurus*, is based. The longest diameter of the scapula (*i. e.* from the glenoid cavity to the anterior border of the ventral plate) is 0,304 (12 inches), and the widest part of the coracoids at the glenoid cavity 0,445 (17·5 inches). This specimen closely resembles the isolated pectoral girdle from the Kimeridge Clay of Ely figured by Seeley in the 'Quart. Journ. Geol. Soc.' vol. xxx. p. 447, fig. 12, as the apparent type of *Colymbosaurus*, and reproduced in fig. 59. *Purchased*, 1875.

40974. (*Fig.*) The imperfect and somewhat crushed coracoids of a larger individual; from Kimeridge Bay. Described and figured by Seeley, *op. cit.* p. 437, fig. 2, as *Murænosaurus*. The greatest transverse diameter is 0,558 (22 inches). The greater part of the median posterior region is broken away. On the ventral aspect of the anterior border the broken base of the median ascending bar is very distinct, although it cannot be determined whether this joined the scapulæ. *Presented by J. C. Mansel-Pleydell, Esq.*, 1868.

42270. The median portion of the anterior region of the coracoids; found in gravel at Himbleton, Worcestershire, being probably derived from the Kimeridge Clay.

Purchased, 1870.

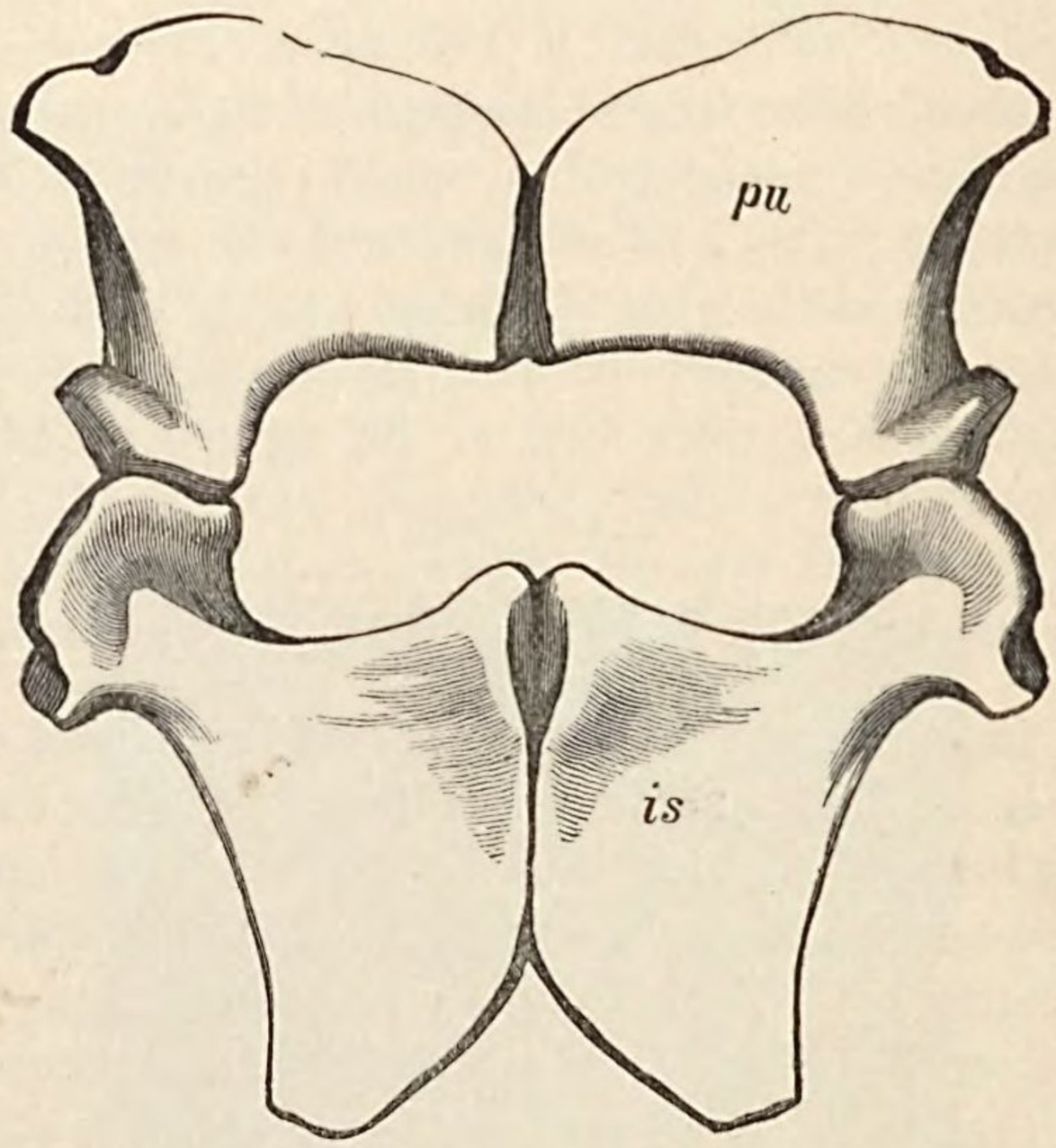
31802. The imperfect left coracoid, of rather smaller size than No. 46833; from the Kimeridge Clay of Shotover, near Oxford. *Purchased*, 1859.

R. 205. (*Fig.*) The left (?) pubis of a large individual; from Kimeridge Bay. Figured in the woodcut on the next page. The diameter from the acetabulum to the periphery is 0,355 (14 inches), and that at right angles to the same 0,406 (26 inches). This specimen closely resembles the larger pubis from Shotover figured by Phillips, *op. cit.* p. 378, in a reversed position as a coracoid. The contour is totally different from the pubis of *Pliosaurus*.

Fox Collection. Purchased, 1882.

40975. A nearly entire left (?) ischium; from Kimeridge Bay. (*Fig.*) Figured in the accompanying woodcut. The diameter from the acetabulum to the periphery is 0,482 (19 inches),

Fig. 65.



Cimoliosaurns (*cf.*) *trochanterius*.—Restoration of the pelvic girdle viewed from the dorsal aspect; from the Kimeridge Clay of Kimeridge. About $\frac{1}{14}$. *pu*, pubis; *is*, ischium.

and that at right angles to the same 0,393 (15·5 inches). The general contour of this specimen is not dissimilar to that of the smaller ischium of *C. plicatus* in the collection of A. N. Leeds, Esq.

Presented by J. C. Mansel-Pleydell, Esq, 1868.

40976. A more imperfect and rather smaller left (?) ischium; from Kimeridge Bay.

Presented by J. C. Mansel-Pleydell, Esq., 1868.

32413. A much smaller left (?) ischium: from the Kimeridge Clay of Boulogne, France. This specimen, which may indicate an immature individual, agrees exactly with the pair of ischia from Shotover, figured by Phillips, *op. cit.* p. 377, fig. 178. *Purchased*, 1875.

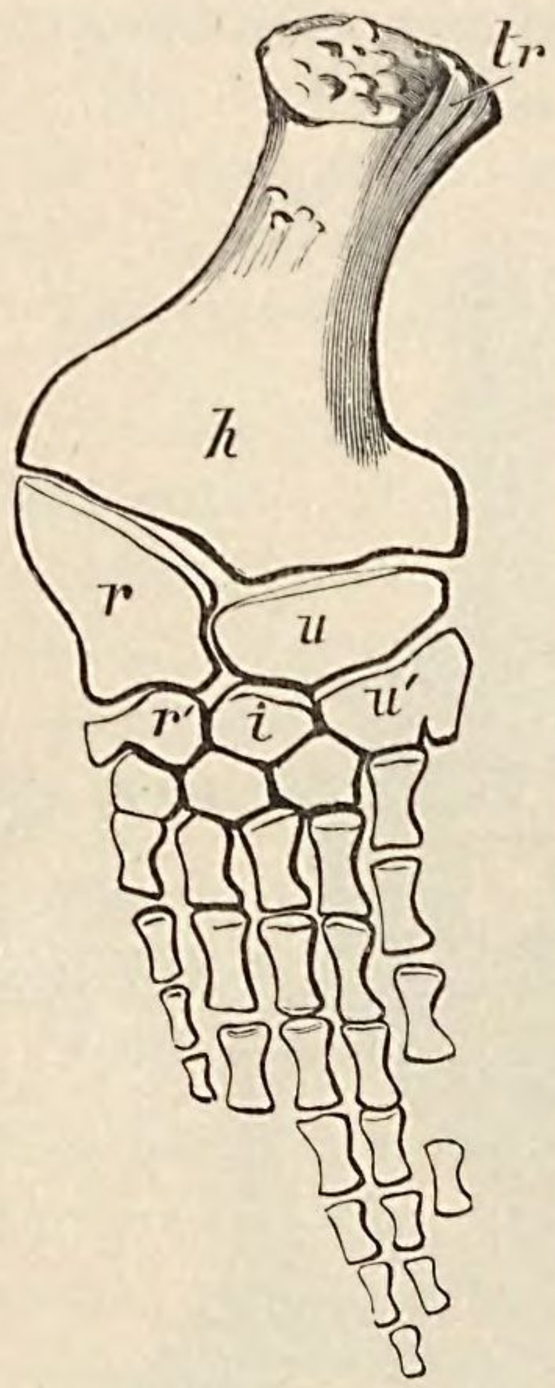
Cimoliosaurus eurymerus (Phillips [1]).

Syn. *Plesiosaurus eurymerus*, Phillips [2].

Considerably smaller than the preceding. Number of cervical vertebræ unknown. Humerus (fig. 66) relatively short, with the distal expansion as much marked on the preaxial as on the post-axial border, and articulating distally only with the radius and ulna, of which the former is elongated, with an oblique superior border and a narrow distal extremity, while the latter is very short and much elongated transversely.

This species was founded upon a pectoral limb from the Oxford Clay of Bedford, of which a cast is figured on p. 315 of Phillips's

Fig. 66.



Cimoliosaurus eurymerus.—Ventral aspect of the right pectoral limb; from the Oxford Clay of Peterborough. About $\frac{1}{10}$. *h*, humerus; *tr*, trochanter of do.; *r*, radius; *u*, ulna; *i*, intermedium; *r'*, radiale; *u'*, ulnare.

'Geology of Oxford' as a pelvic limb. In that specimen, which appears to have been somewhat restored, the proximal extremity of the humerus is imperfect, and the contour of the radius and ulna is somewhat different from that of the corresponding bones of the pectoral limb represented in fig. 66. This, how-

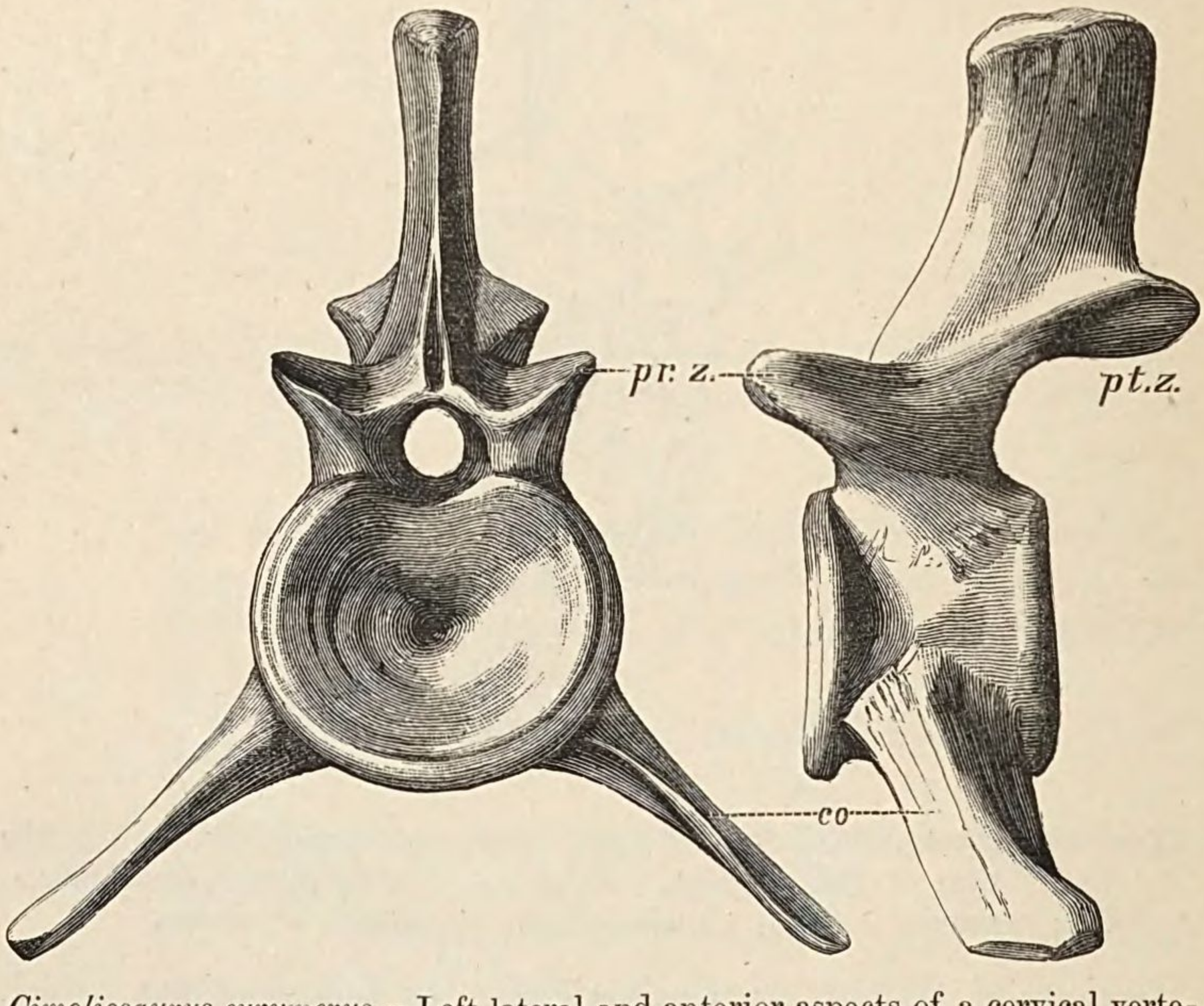
[1] Geology of Oxford, p. 315 (1871).—*Plesiosaurus.*
[2] *Loc. cit.*

ever, may partly be accounted for by the crushing to which the type specimen has evidently been subject, and partly to individual variations, such as are shown in specimens in the collection of Mr. Leeds. The type humerus has a length of 0,406 (16 inches) and a distal diameter of 0,287 (11·3 inches): the corresponding dimensions in the specimen represented in fig. 66 being 0,354 (14 inches) and 0,272 (10·7 inches). Another humerus in the collection of Mr. Leeds (No. 32) has a length of 0,370 (15·5 inches) and a distal diameter of 0,292 (11·5 inches). In one of the specimens in the same collection the elongated ulnare of fig. 66 is divided into two separate bones.

This form, so far as is known at present, can only be distinguished from the following by its superior size, and it remains to be proved that the two do not pass into one another. The dorsals figured by Phillips as *C. oxoniensis* agree with those of the present form.

Hab. Europe (England).

Fig. 67.



Cimoliosaurus eurymerus.—Left lateral and anterior aspects of a cervical vertebra; from the Oxford Clay of Peterborough. $\frac{1}{2}$. *pr.z*, prezygapophysis; *pt.z*, postzygapophysis; *co*, rib.

R. 1284. Cast of a cervical vertebra. The original (fig. 67) belongs to a nearly entire skeleton (No. 31) from the Oxford Clay of Peterborough, Northamptonshire, in the collection of

A. N. Leeds, Esq., of Eyebury, near that town, of which the pectoral limb is shown in fig. 66. The dimensions of the centrum are :—length 0,037 (1·45 inches), height 0,045 (1·75 inches), width 0,061 (2·4 inches); the height from the base of the neural canal to the summit of the neural spine being 0,073 (2·85 inches). The relatively short neural spine is in marked contrast to that of the cervical of *C. richardsoni* No. R. 1283 (p. 242).

Made in the Museum, 1888.

28709. The centrum of an immature cervical vertebra; from the Oxford Clay, locality unknown. This specimen agrees very closely with the preceding, but the ribs were not anchylosed. *Cowderoy Collection. Presented*, 1852.

46488. An associated series of imperfect cervical, dorsal, and caudal vertebræ; from the Oxford Clay of Melksham, near Devizes, Wiltshire. One of the cervicals agrees precisely with No. R. 1284. In several cases the ribs were still separate. *Cunnington Collection. Purchased*, 1875.

46745 a. The centra of three immature cervical vertebræ; from the Oxford Clay near Devizes. These specimens were stated to be from the Kimeridge Clay, but their mineral condition is identical with that of the preceding series. The specimens may indeed have belonged to the same individual, if they are not referable to No. 46484. *Cunnington Collection.*

24803. Two imperfect cervical vertebræ; from the Oxford Clay of Wootton-Bassett, Wiltshire.

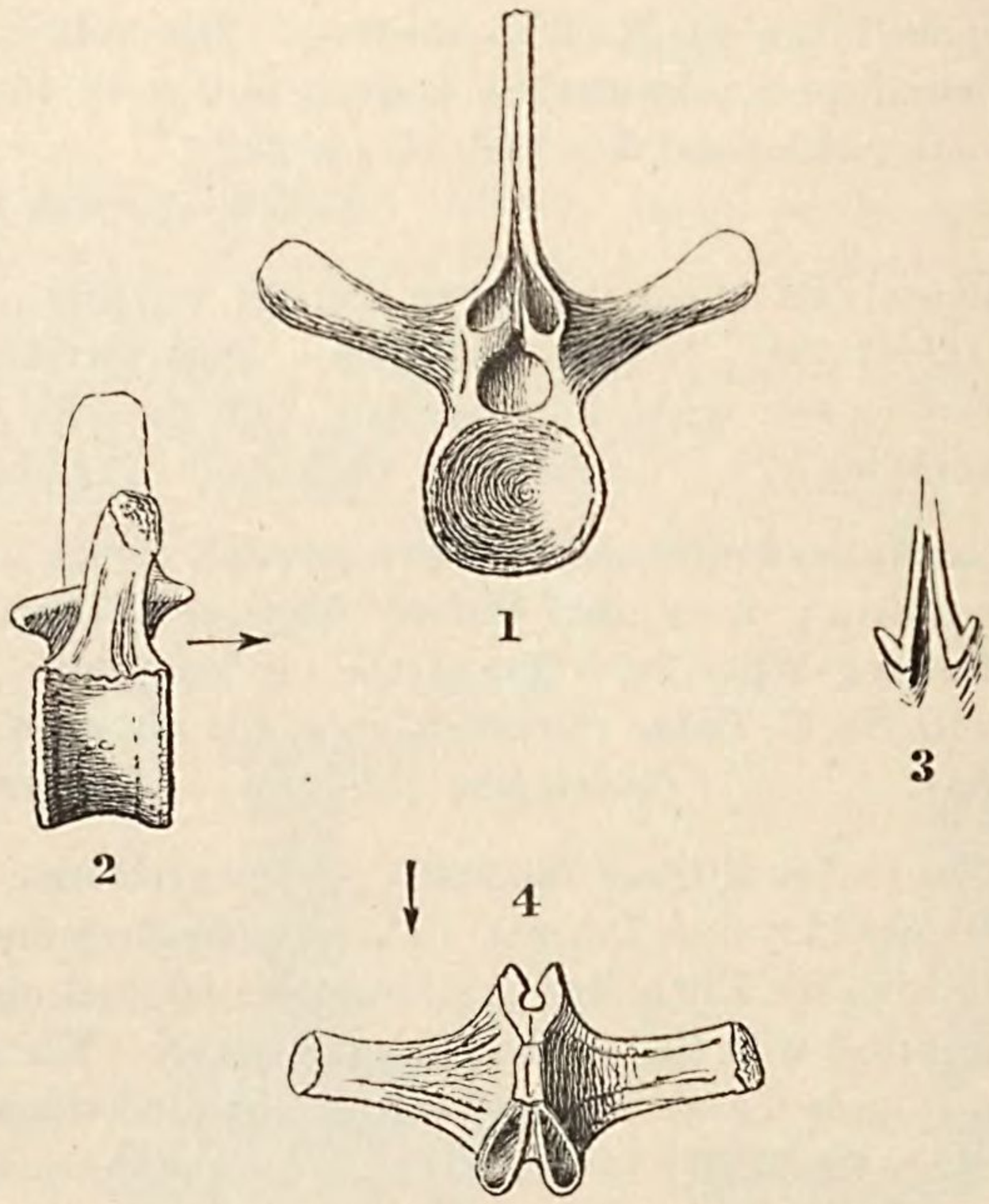
Cunnington Collection. Purchased, 1849.

46484. The centra of five dorsal and two caudal vertebræ; from the Oxford Clay near Devizes. These specimens indicate a somewhat larger individual than No. 46488. The dimensions of one of the dorsal centra are :—length 0,051 (2·0 inches), height 0,065 (2·5 inches), width 0,074 (2·9 inches). The forward overhang of the upper part of the centrum of the dorsals is more marked than in *C. trochanterius*. *Cunnington Collection. Purchased*, 1875.

33290. An imperfect dorsal vertebra; from the Oxford Clay of Weymouth, Dorsetshire. The transverse processes and zygapophyses are wanting. This specimen agrees very closely in size with the dorsal represented in the accompanying woodcut, which was referred by Phillips to

C. oxoniensis. The dimensions of the centrum are :—length 0,045 (1·75 inches), height 0,054 (2·12 inches), width 2·55 inches ; the height from the base of the neural canal to the summit of the spine being 0,121 (4·75 inches). Except for its superior size this specimen cannot be distinguished from the type dorsals of *C. oxoniensis.* The specimen is adult. *Purchased*, 1858.

Fig. 68.



Cimoliosaurus (*cf.*) *eurymerus.*—1, anterior aspect ; 2, right lateral aspect ; 3, prezygapophysis ; 4, neural aspect of dorsal vertebra ; from the Oxford Clay of Oxfordshire. (*After Phillips.*)

33289. Eight associated dorsal vertebræ of a young individual of this or the next species ; from the Oxford Clay of Weymouth. The neural arches are separate from the centra. In one specimen the dimensions of the centrum are :—length 0,025 (0·86 inch), height 0,030 (1·16 inches), width 0,035 (1·36 inches). *Purchased*, 1858.

46487. An imperfect vertebra probably belonging to the lumbar region ; from the Oxford Clay of Chippenham, Wiltshire. *Cunnington Collection.*

Cimoliosaurus oxoniensis (Phillips [1]).

Syn. *Plesiosaurus oxoniensis*, Phillips [2].

Typically of very small size, by which character alone, so far as is at present known, it is distinguished from the preceding form. Judging from the similarity in the vertebræ, the limb-bones were probably like those of *C. eurymerus*. The pectoral girdle figured under the name of the present species on p. 310 of Phillips's 'Geology of Oxford' in a reversed position, and regarded as the pelvis, was not associated with the type vertebræ, but was obtained from the Oxford Clay of Summertown, Oxfordshire, in association with the pectoral limb figured on p. 312 of the same. In the latter figure the ulna (fibula of Phillips) is relatively too long, and the arrangement of the bones on the postaxial border is incorrect; the whole contour of the specimen is, however, that of *C. plicatus*, to which it thus appears that both the pectoral girdle and limb should be referred. Apparently on the evidence of this girdle the present species was referred by Seeley [3] to a subgenus of *Muræosaurus*; the restoration given by Phillips is, however, incorrect, since the specimens themselves distinctly show the remains of a bar connecting the scapulæ with the coracoids in the middle line. Whether the preceding form is more than a large race of the present species has to be proved.

Hab. Europe (England and [?] France).

R. 1285. Casts of three imperfect vertebræ belonging to the cervical, dorsal, and caudal regions. The originals are the types; and were obtained from the Oxford Clay (Middle Jurassic) of Long-Marston, Oxfordshire, and are preserved in the Museum at Oxford. The cervical is the last of the series of six figured on p. 308 of Phillips's 'Geology of Oxford.' In the cervical the dimensions of the centrum are:—length 0,028 (1·1 inches), height 0,033 (1·3 inches), and width 0,041 (1·6 inches); the corresponding dimensions of the dorsal being:—length 0,043 (1·7 inches), height 0,049 (1·94 inches), width 0,055 (2·18 inches). Phillips regarded the cervicals as being close to the head, but this appears to be incorrect. The caudal is one of the specimens figured on p. 310 of Phillips's work.

Made in the Museum, 1888.

[1] Geology of Oxford, p. 307 (1871).—*Plesiosaurus.*
[2] *Loc. cit.*
[3] Quart. Journ. Geol. Soc. vol. xxx. p. 448.

31919. An imperfect cervical vertebra; from the Oxford (?) Clay of Shotover, near Oxford. The specific reference is provisional.
Purchased, 1852.

46787. A similar cervical vertebra; from the Oxford Clay near Devizes, Wiltshire.
Cunnington Collection. Purchased, 1875.

32720. The centrum of an immature cervical vertebra belonging either to this or the preceding form; from the Oxford Clay of Vaches-Noires (Calvados), France.
Tesson Collection. Purchased, 1857.

Cimoliosaurus, sp.

The following specimens from the Cornbrash indicate a member of the present group, which is apparently allied in the structure of the cervical vertebræ to *C. eurymerus*. Some of the caudal vertebræ indicate, however, a form considerably larger than the latter.

Hab. Europe (England).

47169 i. The centrum of a small and immature cervical vertebra; from the Cornbrash (Lower Jurassic) of Stilton, Northamptonshire. Although smaller, this specimen closely resembles the cervicals of *C. eurymerus* No. 46488 (p. 207).
Sharp Collection. Purchased, 1876.

28625. A right humerus imperfect at the distal extremity; from the Cornbrash of Rushden, Northamptonshire. This specimen, which agrees in relative size with the preceding, shows all the characters of the humerus of the present subgroup, having the large and oblique trochanter, the rugosity on the upper part of the ventral surface, and the large distal expansion.
Presented by the Rev. A. W. Griesbach, 1853.

The following specimens are provisionally referred to this subgroup.

47169 j. The centrum of an anterior caudal vertebra with the terminal faces crushed in; from the Cornbrash of Stilton. This specimen indicates a considerably larger animal

than those to which the caudals of No. 46488 of *C. eurymerus* belonged; the centrum is also more elongated in a vertical direction. *Sharp Collection.*

47169 k. The centrum of an anterior caudal vertebra; from Stilton. This specimen was associated with the preceding, and has the terminal faces crushed in in the same manner.
Sharp Collection.

B. *Typical Group.*

Vertebræ with the centra usually more or less elongated (especially in the anterior cervical region), and their terminal faces nearly flat; cervicals with the neural spines tall, the zygosphenes deep, and the zygapophyses much curved; in some cases anchylosis of the chevrons to the caudal centra. Humerus relatively small, with moderate distal expansion, and with the trochanter in some cases small and never extending obliquely outwards from the shaft; when only the radius and ulna articulate with the humerus the ulna less elongated transversely than in the preceding group, and separated by an interval from the radius.

This group includes the type species, and also *Elasmosaurus* of Cope, *Mauisaurus* of Hector, and the type of *Murænosaurus* of Seeley.

Cimoliosaurus magnus, Leidy[1].

Syn. *Discosaurus vetustus*, Leidy[2].

The type species, known only by detached vertebræ. Of large size, but smaller than *C. constrictus*. Cope's identification of *Discosaurus vetustus* with this species has been already mentioned. The vertebræ figured by Leidy as lumbar are really cervical. The species was founded upon the evidence of vertebræ from the Cretaceous of New Jersey; *Discosaurus* being described on specimens from both that district and Alabama.

Hab. North America.

40981 a. An imperfect vertebra probably belonging to the lumbar region; from the Cretaceous of Withers-Green County, Alabama. From the subcylindrical terminal faces of the centrum it is inferred that this specimen belongs to the lumbar rather than the "pectoral" region, since the

[1] Proc. Ac. Nat. Sci. Philad. for 1851, p. 325 (1852).
[2] *Ibid.* p. 326.

"pectorals" figured by Leidy, and also those of *C. constrictus*, have elliptical faces, while in the posterior dorsals of the latter these faces are subcircular. The dimensions of the centrum are:—length 0,077 (3·02 inches), height 0,093 (3·65 inches), width 0,113 (4·44 inches). The specimen agrees closely in size with the type vertebræ figured by Leidy in his 'Cretaceous Reptilia of the United States' (Smiths. Contrib. Knowl. 1864), pls. v., vi.; and apparently closely resembles the specimen represented in pl. v. fig. 16 as an anterior dorsal. The general contour of the specimen agrees so closely with that of the dorsals of *C. constrictus* and *C. haasti*, as to leave no doubt of the generic identity of the three forms. There is a somewhat prominent ridge on the hæmal aspect, between two large foramina. The neural spine and ribs are wanting.

Presented by Sir C. Lyell, Bart., 1859.

Cimoliosaurus constrictus (Owen [1]).

Syn. *Plesiosaurus constrictus*, Owen [2].
Elasmosaurus constrictus, Cope [3].

Including:—
Mauisaurus gardneri, Seeley [4].
Plesiosaurus gardneri, Whidborne [5].
Plesiosaurus helmerseni, Kiprijanoff [6].
Pliosaurus (?) *gigas*, Schröder [7].

Of gigantic size, with the neck of enormous length. Cervical vertebræ about 35 in number; those of the anterior region with their centra greatly elongated, laterally constricted, flattened and carinated on the hæmal surface, and the extremities much expanded, with their terminal faces very wide and slightly cupped; posterior cervicals much shorter, their length being absolutely less than that of the middle cervicals, and their terminal faces nearly flat; dorsals with the terminal faces of the centra flat and nearly circular. Humerus (judging from the specimen figured by Kiprijanoff, *op. cit.* pl. xiv.) of medium size, with moderately wide distal expansion,

[1] In Dixon's 'Geology of Sussex,' 1st ed. p. 398 (1850).—*Plesiosaurus*.
[2] *Loc. cit.*
[3] Trans. Amer. Phil. Soc. vol. xiv. pt. i.—Advance separate copy, p. 42 (1869). Omitted in subsequent issue (1870).
[4] Quart. Journ. Geol. Soc. vol. xxxiii. p. 541 (1877).
[5] *Ibid.* vol. xxxvii. table facing p. 480 (1881).
[6] Mém. Ac. Imp. St. Pétersbourg, vol. xxx. art. 6, p. 17 (1882).
[7] Jahrb. preuss. geol. Landesanstalt for 1884, p. 322 (1885).

a large proximal trochanter, and articulating distally with only the radius and ulna, which were probably of the type of those of the next species.

The skeleton described as *Mauisaurus gardneri*, from the Folkestone Gault, has precisely similar anterior cervicals; while posterior cervicals and dorsals from the Upper Chalk of the shores of the Baltic described by Schröder under the names of *Plesiosaurus helmerseni* and *Pliosaurus? gigas* cannot be distinguished from the corresponding vertebræ of the former. The name *P. helmerseni* was applied to vertebræ and limb-bones from the "osteolite" (? Gault) of Moscow, some of which indicate smaller individuals.

The absence of any possibility of specifically distinguishing the forms to which the above-mentioned names have been applied renders their inclusion under a single specific name a necessity. Kiprijanoff, from the analogy of *Plesiosaurus homalospondylus*, places the number of cervical vertebræ at about 40.

Hab. Europe (England, Russia, and Sweden).

25842–3. (*Fig.*) The imperfect and somewhat crushed centra of two anterior cervical vertebræ; from the Chalk of Sussex. The types. The smaller and least imperfect specimen (25842) is figured by Owen in Dixon's 'Geology of Sussex,' pl. xxxvii. figs. vi., vii. Its dimensions are:—length 0,057 (2·26 inches), height 0,042 (1·64 inches), width 0,056 (2·2 inches); it is probable that the excessive expansion of the extremities is due to pressure. The second specimen is larger, and lacks this great terminal expansion; both examples are adult. They are noticed by Cope in an advance separate copy from the 'Trans. Amer. Phil. Soc.' vol. xiv. pt. i. p. 42, where they are referred to the caudal region (see *C. haasti*, p. 215); but this notice was omitted in the subsequent issue.

Dixon Collection. Purchased, 1851.

47295. (*Fig.*) A considerable portion of the skeleton; from the Gault of Folkestone, Kent. The type of *Mauisaurus gardneri*. The series comprises one tooth, about 60 vertebræ, more or less imperfect, an imperfect humerus and femur, and a phalangeal. The tooth, a middle cervical, a late cervical, a "pectoral," and a dorsal vertebra, and the phalangeal are figured by Seeley in the 'Quart. Journ. Geol. Soc.' vol. xxxiii. pl. xxiii. The tooth is slender and of the ordinary Plesiosaurian type. The first of the cervicals now remaining is short, the dimensions of its centrum being:—

length 0,027 (1·06 inches), height 0·028 (1·1 inches), width 0,036 (1·4 inches). In the second the length of the centrum is 0,072 (2·84 inches). The extremities of two succeeding cervicals marked 4 and 5, together with the second remaining centrum, closely resemble Nos. 25842–3; but it is probable that the centra corresponding to those two specimens are missing from the series. These early cervicals agree in all respects with the type cervicals of *P. helmerseni* figured by Kiprijanoff in the 'Mém. Ac. Imp. St. Pétersbourg,' vol. xxx. art. 6, pls. viii. and xi. In the cervical centrum marked 10 the length is 0,089 (3·5 inches), the height 0,066 (2·6 inches), and the width 0,092 (3·6 inches): this specimen closely resembling the slightly larger cervical from the Upper Chalk figured by Schröder in the 'Jahrb. preuss. geol. Landesanstalt' for 1884, pl. xv. fig. 1, as *P. helmerseni*. The dimensions of a posterior cervical centrum marked No. 30 are:—length 0,106 (4·2 inches), height 0,109 (4·3 inches), width 0,152 (6·0 inches). In a "pectoral" (No. 33) the length is 0,102 (4·0 inches), height 0,117 (4·6 inches), width 0,152 (6·0 inches); this specimen closely resembles the "pectoral" of a smaller individual figured by Schröder, *op. cit.* pl. xv. fig. 2, as *P. helmerseni*. In one of the dorsals the dimensions of the centrum are:—length 0,102 (4·0 inches), height 0,127 (5·0 inches), width 0·135 (5·3 inches). These dorsals cannot be distinguished from the specimen from the Chalk of Sweden, figured by Schröder, *op. cit.* pl. xvi. fig. 1, as the type of *Pliosaurus* (?) *gigas*, the Plesiosaurian nature of the latter being at once shown by the anchylosis of the arch to the centrum. In a dorsal centrum of *P. helmerseni* figured by Kiprijanoff, *op. cit.* pl. xii. fig. 2, the dimensions are:—length 0,099 (3·9 inches), height 0,114 (4·5 inches), width 0,140 (5·5 inches), or fully as large as those of the present specimen. *Gardner Collection. Purchased*, 1876.

28684. The centrum of a small immature dorsal vertebra provisionally referred to this or the next species; from the Chalk of Dorsetshire. Length 0,043 (1·7 inches), height 0,056 (2·24 inches), width 0,061 (2·4 inches). Although considerably smaller this specimen closely resembles the dorsal figured by Kiprijanoff, *op. cit.* pl. vii. fig. 1.

Mantell Collection. Purchased, 1853.

****Cimoliosaurus smithi** (Owen [1]).

Syn. *Plesiosaurus smithi*, Owen [2].

A doubtful species, founded upon a dorsal vertebra from the Upper Chalk which appears to resemble those of *C. constrictus*, but is of smaller size; the dimensions of the centrum being:—length 0,047 (1·87 inches), height 0,064 (2·5 inches), width about 0,081 (3·4 inches).

Hab. Europe (England).

49007. (*Fig.*) An associated series of phalangeals probably belonging to this species; from the Upper Chalk of Burham, Kent. Figured by Owen in his 'Cretaceous Reptilia,' pt. i. pl. xix. These specimens were probably associated with the dorsal vertebra figured in pl. xvii. of the same memoir, which was subsequently made the type of *Plesiosaurus smithi*. *Purchased*, 1878.

R. 30. Two phalangeals of similar type; from the Gault of Folkestone. These specimens may belong to the preceding species. *Gardner Collection. Purchased*, 1880.

Cimoliosaurus haasti (Hector [3]).

Syn. *Mauisaurus haasti*, Hector [4].

The type of *Mauisaurus*. Apparently closely allied to *C. constrictus*; but with a shorter and more expanded humerus, and perhaps also distinguished by certain vertebral characters noticed below. This species may possibly prove to be inseparable from *Elasmosaurus platyurus*, Cope [5], the type of that genus. In describing the latter in an advance separate copy [6] from the 'Trans. Amer. Phil. Soc.' vol. xiv. pt. i. pp. 42–52, pls. ii., iii. (1869), Cope placed the skull at the caudal extremity of the body, and described (p. 42) the vertebræ as having the prezygapophyses directed downwards, the pectoral and pelvic girdles being likewise transposed. In the final issue (1870) both the description and plate were amended, but there still seems to be some discrepancy regarding caudal and cervical vertebræ.

Hab. New Zealand.

[1] Brit. Foss. Rep. vol. iv., Index, p. iv (1884).—*Plesiosaurus.*
[2] *Loc. cit.*
[3] Trans. N. Zealand Inst. vol. vi. p. 346 (1874).—*Mauisaurus.*
[4] *Loc. cit.*
[5] Proc. Ac. Nat. Sci. Philad. for 1868, p. 93 (1868).
[6] In library of British Museum (Nat. Hist.).

R. 827. A mass of matrix containing three imperfect anterior cervical vertebræ; from the Cretaceous of Amuri Bluff, North Island, New Zealand. Allowing for the absence of the ribs and the abrasion of the hæmal carina, these specimens accord very closely with the cervicals of *C. constrictus* in the skeleton No. 47295 marked 7 and 14.

By exchange with the Wellington Museum, 1880.

R. 827 a. An imperfect centrum of what is apparently a late cervical vertebra, in matrix; associated with the preceding.

By exchange with the Wellington Museum, 1880.

R. 827 b. Mass of rock containing the broken centrum of a (?) "pectoral" vertebra and a carpal bone; associated with the preceding.

By exchange with the Wellington Museum, 1880.

47344. Cast of a restored dorsal vertebra. The original, which wants the neural spine and the left transverse process, was obtained from Amuri Bluff, and is one of the types. It is preserved in the Museum at Wellington, and is figured by Hector in the 'Trans. N. Zealand Inst.' vol. vi. pl. xxix. It closely resembles the dorsal of the type of *Elasmosaurus platyurus*, figured by Cope, *op. cit.* pl. ii., although in that figure the neural spine is made much too tall. The dimensions of the centrum are:—length 0,112 (4·4 inches), height 0,132 (5·2 inches), width 0,137 (5·4 inches). The very prominent hæmal carina is apparently an incorrect restoration.

Presented by the Director of the Wellington Museum, 1876.

R. 829. Two imperfect associated trunk vertebræ apparently belonging to the anterior dorsal region; from Amuri Bluff. There is a deep lateral depression on the side of the centrum immediately below the arch, of which there is only a trace in the vertebra marked 34 in the above-mentioned skeleton of *C. constrictus*: this feature may be a specific character. The terminal faces have a distinct central mammilla, which is faintly indicated in the European species.

By exchange with the Wellington Museum, 1880.

R. 829 a. A smaller imperfect vertebra; from Amuri Bluff.

By exchange with the Wellington Museum, 1880.

47343. Cast of the bones of the right pectoral limb. The original is one of the types, and was obtained from Amuri Bluff; it is preserved in the Museum at Wellington, and is figured by Hector, *op. cit.* pl. xxix., with some inaccuracies of detail. This specimen was associated with the coracoids figured on the same plate. The humerus has a length of 0,340 (14·0 inches) and a distal diameter of 0,280 (8·2 inches). The head is spherical, and there is a very prominent proximal trochanter; while there is a distinct rugosity below the head, and the distal extremity is equally expanded on both borders. In the humerus of *C. constrictus* (*helmerseni*), figured by Kiprijanoff in the 'Mém. Ac. Imp. St. Pétersbourg,' vol. xxx. art. 6, pl. xiv., the contour of the proximal extremity is similar, but the shaft is relatively longer, and the distal expansion of the preaxial border much less marked than the postaxial. The radius and ulna are laterally expanded.
Presented by the Director of the Wellington Museum, 1876.

R. 830. Slab showing the distal extremity of the femur, the entire fibula, and some other bones of the paddle; from Amuri Bluff. The femur has the postaxial border more expanded than the preaxial. The fibula is less expanded in a transverse direction than the ulna, and resembles the corresponding bone of the European species figured by Kiprijanoff, *op. cit.* pl. xiv. fig. 2.
By exchange with the Wellington Museum, 1880.

R. 830 a. A series of detached phalangeals; from Amuri Bluff.
By exchange with the Wellington Museum, 1880.

Cimoliosaurus planus (Owen [1]).

Syn. *Plesiosaurus planus*, Owen [2].
Plesiosaurus pachyomus, Owen [3] (*in parte*).

A comparatively small species, apparently allied to *C. constrictus*, but with the centra of the vertebræ, especially in the hinder cervical and dorsal regions, relatively shorter, and their terminal faces perhaps somewhat flatter, and (so far as can be determined) ellipsoidal throughout a great part of the series. The anterior or middle cervicals are absolutely much longer than the posterior cervicals and dorsals.

[1] Cretaceous Reptilia (Mon. Pal. Soc.), suppl. iv. p. 2 (1864).—*Plesiosaurus.*
[2] *Loc. cit.*
[3] *Ibid.* pt. i. pl. xxi. fig. 1 (1851).

The early dorsal vertebra from the Cambridge Greensand figured by Owen in his 'Cretaceous Reptilia,' pt. i. pl. xxi. fig. 1, under the name of *P. pachyomus* (*vide suprà*, p. 185) belongs to this species, of which the types are from the same deposits. Sauvage [1] records this species from the Gault of France, while Kiprijanoff [2] figures a vertebra from the probably equivalent "osteolite" of Russia.

Hab. Europe (England, France, and Russia).

The following specimens are from the Cambridge Greensand, and include some of the types.

36154. The centrum of an anterior cervical vertebra, in a rolled condition. This specimen, although relatively shorter than the anterior cervicals of the preceding species, has precisely the same general contour. *Purchased*, 1861.

36154 a. The imperfect centrum of a rather shorter anterior cervical vertebra. *Purchased*, 1861.

35343. The imperfect centrum of a smaller anterior cervical vertebra. *Purchased*, 1859.

35386. (*Fig.*) The imperfect centrum of a later cervical vertebra. Figured by Owen in his 'Cretaceous Reptilia' (Mon. Pal. Soc.) suppl. iv. pl. iii. figs. 7–9. *Purchased*, 1860.

35287. (*Fig.*) The imperfect centrum of a posterior cervical or pectoral vertebra. Figured by Owen, *op. cit.* pl. ii. figs. 1, 2. *Purchased*, 1859.

36152. (*Fig.*) The centrum of a larger posterior cervical vertebra. Figured by Owen, *op. cit.* pl. ii. figs. 3–5. Length 0,035 (1·38 inches), height 0,034 (1·33 inches), width 0,053 (2·08 inches). *Purchased*, 1861.

35387. (*Fig.*) The centrum of a slightly larger "pectoral" vertebra. Figured by Owen, *op. cit.* pl. ii. figs. 6–9. *Purchased*, 1860.

46379. The imperfect centrum of a cervical vertebra. *Purchased*, 1875.

35388. (*Fig.*) The centrum of a posterior cervical vertebra. Figured by Owen, *op. cit.* pl. iii. figs. 1–4. *Purchased*, 1860.

[1] Mém. Soc. Géol. France, sér. 3, vol. ii. art. 4, p. 26.
[2] Mém. Ac. Imp. St. Pétersbourg, vol. xxx. art. 6, pl. viii. fig. 4.

35341. An imperfect (?) "pectoral" vertebra. Figured by Owen, (*Fig.*) *op. cit.* pl. iii. figs. 5, 6. *Purchased*, 1859.

36152. Four imperfect centra belonging either to the "pectoral" or lumbar region. *Purchased*, 1861.

R. 483. A very similar specimen belonging to an adult individual. *Presented by Sir R. Owen, K.C.B.*, 1884.

36153. The centrum of an anterior dorsal vertebra. Length 0,037 (1·46 inches), height 0,051 (2·0 inches), width 0,068 (2·7 inches). This specimen resembles the earlier dorsal figured by Owen, *op. cit.* pt. i. pl. xxi. fig. 1, as *P. pachyomus*. *Purchased*, 1861.

36153 a. Two similar specimens, not improbably associated with the preceding. *Purchased*, 1861.

35284. The rolled centrum of an anterior dorsal vertebra. *Purchased*, 1859.

35305. The centrum of a small later dorsal vertebra. The contour of the terminal faces has become subcordiform. *Purchased*, 1859.

36153 b. A larger imperfect centrum, probably belonging to the later dorsal series of this species. *Purchased*, 1861.

The following specimens indicate the existence of this or a closely allied species at the period of the Lower Greensand; their resemblance to the Upper Cretaceous specimens and the absence of vertebræ of similar type in the Kimeridge Clay indicate that these specimens were not derived from the latter deposit. No characters are shown by which these vertebræ can be distinguished from those from the Cambridge Greensand.

42090. Two imperfect anterior cervical vertebræ; from the Neocomian bone-bed of Potton, Bedfordshire. *Purchased*, 1870.

40453. Three imperfect anterior cervical vertebræ; from Potton. *Purchased*, 1867.

40453 a. The centrum of a "pectoral" vertebra; from Potton. *Purchased*, 1867.

42032. The centrum of a "pectoral" vertebra; from Potton. *Purchased*, 1870.

40449. The centrum and base of the arch of a "pectoral" vertebra; from Potton. *Purchased*, 1867.

Specifically undetermined specimens from the Cambridge Greensand.

35282–3. The associated basioccipital and conjoint atlas and axis vertebræ. *Purchased*, 1859.

35291–2. The associated articular bones of a mandible. *Purchased*, 1859.

47263. A rolled propodial bone of medium size. *Gardner Collection.* *Purchased*, 1876.

47264. An imperfect propodial of similar dimensions. *Gardner Collection.*

35275. A smaller humerus (?), with the proximal extremity much waterworn. *Purchased*, 1859.

The following specimen is from the Upper Greensand of Port-du-Rhône, France.

33180. A humerus (?) of smaller size than the preceding. *Purchased.*

Specifically undetermined specimen from the Chalk.

39437. An imperfect dorsal vertebra; from the Chalk of England, locality unknown. Dimensions of centrum:—length 0,052 (2·05 inches), height 0·055 (2·15 inches), width 0,059 (2·35 inches). *Bowerbank Collection.* *Purchased*, 1865.

Cimoliosaurus australis (Owen [1]).

Syn. *Plesiosaurus australis*, Owen [2].
Plesiosaurus crassicostatus, Owen [3].

Apparently the antipodal representative of *C. planus*, but attaining somewhat larger dimensions. The thicker ribs of *Plesiosaurus crassicostatus* can scarcely be regarded as a good specific character even if similar ribs did not belong to the individual indicated by the type specimens.

Hab. New Zealand.

[1] Rep. Brit. Assoc. for 1861—Trans. of Sections, p. 122 (1862).
[2] Geol. Mag. dec. 1, vol. vii. p. 53 (1870).

36074. The imperfect centra of two posterior cervical vertebræ; from the Cretaceous of the South Island, New Zealand. The type specimens. Described by Owen in the 'Rep. Brit. Assoc.' for 1861, Trans. of Sections, p. 122; and also by Hector, in the 'Trans. N. Zealand Inst.' vol. vi. p. 338; the horizon in the original description being described as Jurassic. Dimensions :—length 0,044 (1·75 inches), height 0,057 (2·25 inches), width 0,090 (3·55 inches). These specimens cannot be distinguished from the cervicals of the type of *P. crassicostatus*, figured by Owen in the 'Geol. Mag.' dec. 1, vol. vii. pl. iii., and by Hector, *op. cit.* pl. xxviii. Neither the ribs nor arch were anchylosed to the centrum. The resemblance to the posterior cervicals of *C. planus* is extremely close.

Presented by C. T. H. Hood, Esq., 1861.

R. 831. The centrum of an earlier cervical vertebra of similar type; from the Cretaceous of Waipara, South Island, New Zealand. *By exchange with the Wellington Museum*, 1880.

R. 837. The centra and arches of immature dorsal vertebræ; from Waipara. The larger centrum closely resembles the dorsal of *C. planus* No. 36153 (p. 219) but is smaller.

By exchange with the Wellington Museum, 1880.

37413. Slab showing a series of imperfect cervical ribs together with impressions of the centra of the vertebræ; from the South Island. *Presented by C. T. H. Hood, Esq.*, 1863.

36075. Slab showing portions of ribs; from the South Island.

Presented by C. T. H. Hood, Esq., 1861.

36073. Fragment of the anterior portion of the coracoids; from the South Island. This specimen was associated with the type vertebræ, and is described by Owen in the passage cited. The general contour is of the general type obtaining in the English Jurassic specimen No. 46833 (p. 203), but there is a more gradual slope from the sides towards the middle bar for connection with the scapulæ.

Presented by C. T. H. Hood, Esq., 1861.

36073 a. Fragment of a scapula of the same individual.

Presented by C. T. H. Hood, Esq., 1861.

Cimoliosaurus chilensis (Gay [1]).

Syn. *Plesiosaurus chilensis*, Gay [2].

Of large size, but very imperfectly known. Possibly one of the species described by Leidy or Cope may prove to belong to this form.

Hab. South America.

38013. The centrum of a caudal vertebra; from Mesozoic (? Cretaceous) beds at San Vicente, near Concepcion, Chili. Noticed by Blake in the 'Geologist' for 1862, p. 110. Length 0,050 (1·95 inches), height 0,074 (2·94 inches), width 0,100 (3·95 inches). The transverse processes are anchylosed. This specimen approximates to the somewhat larger caudal of *C.* (*Discosaurus*) *magnus*, figured by Leidy in his 'Cretaceous Reptilia of the United States' (Smiths. Contrib. Knowl. 1864), pl. v. figs. 7–9.

Presented by W. Bollaert, Esq., 1862.

Cimoliosaurus latispinus (Owen [3]).

Syn. *Plesiosaurus latispinus*, Owen [4].

Imperfectly known. Apparently closely allied to the Kimeridgian *C. truncatus* (*infrà*, p. 230), with which it agrees in size and the general structure of the cervical vertebræ. The lateral surfaces of these vertebræ are, however, less depressed, and the terminal faces more deeply cupped.

The unnamed cervical vertebra from the Neocomian (Lower Greensand) of Switzerland, figured by Meyer in the 'Palæontographica,' vol. vi. pl. iii. figs. 1–3, belongs to this species.

Hab. Europe (England and Switzerland).

R. 1309. (*Fig.*) A broken slab containing a portion of the skeleton, from the Lower Greensand of Maidstone, Kent. The type specimen. Comprises nine vertebræ, from the cervical, "pectoral," and dorsal regions, ribs, an imperfect scapula, coracoid, ilium, and what is probably an ischium, together with several phalangeals. A cervical, a pectoral, and a dorsal vertebra, as well as a portion of the coracoid and the ilium, are figured by Owen in his 'Cretaceous Reptilia'

[1] Historia fisica y politica de Chile—Zool. vol. ii. p. 133 (1848).—*Plesiosaurus.*

[2] *Loc. cit.*

[3] Cat. Foss. Rept. Mus. R. Coll. Surg. p. 63 (1854).—*Plesiosaurus.* he name must, however, date from the description in 1864.

[4] *Loc. cit.*

(Mon. Pal. Soc.), suppl. iv. pls. vii.–ix. (1864). The dimensions of a cervical centrum are:—length 0,070 (2·75 inches), height 0,061 (2·4 inches); of a "pectoral":—length 0,063 (2·46 inches), height 0,065 (2·56 inches), width 0,085 (3·35 inches); of a dorsal:—length 0,055 (2·17 inches), height 0,063 (2·48 inches), width 0,068 (2·68 inches); and of another dorsal:—length 0,067 (2·65 inches), height 0,072 (2·85 inches).

Presented by W. H. Bensted, Esq. About 1862.

11901. The centrum of a small dorsal vertebra provisionally referred to this species; from the Lower Greensand of Farringdon, Berkshire. This specimen, which belongs to an immature individual, has the same proportions as in the dorsals of the type. *Mantell Collection. Purchased*, 1838.

Cimoliosaurus neocomiensis (Campiche [1]).

Syn. *Plesiosaurus neocomiensis*, Campiche [2].
? *Plesiosaurus gurgitis*, Renevier [3].

Still more imperfectly known than the preceding, but apparently of smaller dimensions, with the centra of the "pectoral" and dorsal vertebræ relatively shorter, and their terminal faces less cupped and more mammillated.

The vertebræ referred to this species by Owen and Kiprijanoff are noticed above (p. 183).

Hab. Europe (Switzerland).

40164. Cast of an imperfect "pectoral" vertebra, probably belonging to this form. The original was obtained from the Middle Neocomian (Lower Greensand) of Switzerland. Figured by Pictet and Campiche in the 'Paléontologie Suisse,' sér. 2, pl. v. fig. 2. Dimensions of centrum:—length 0,037 (1·45 inches), height 0,042 (1·65 inches), width 0,055 (2·15 inches). The anchylosis of the arch indicates maturity.

Presented by M. Campiche, 1866.

40164 a. Cast of the centrum of a dorsal vertebra. The original is the type, and was obtained from the Lower Neocomian of Switzerland; it is figured by Pictet and Campiche, *op. cit.* pl. vi. fig. 1; a nearly similar specimen being figured

[1] In Pictet's 'Matériaux pour la Paléontologie Suisse,' sér. 2, art. 1, p. 42 (1858–60).—*Plesiosaurus.*

[2] *Loc. cit.*

[3] *Ibid.* sér. 1, art. 1, p. 5 (1858).

by Meyer in the 'Palæontographica,' vol. vi. pl. iii. figs. 4–5. Length 0,047 (1·87 inches), height 0,059 (2·34 inches), width 0,067 (2·63 inches).

Presented by M. Campiche, 1866.

40164 b. Cast of the centrum of a smaller dorsal vertebra, probably belonging either to this or the preceding species. The original was obtained from the Lower Neocomian, and is figured by Pictet and Campiche, *op. cit.* pl. vi. fig. 2.

Presented by M. Campiche, 1866.

40165. Cast of an imperfect rib. The original was obtained from the Middle Neocomian, and is figured by Pictet and Campiche, *op. cit.* pl. v. fig. 3. *Presented by M. Campiche*, 1866.

Cimoliosaurus limnophilus (Koken [1]).

Syn. *Plesiosaurus limnophilus*, Koken [2].
(?) *Plesiosaurus degenhardti*, Koken [3].

Apparently allied in vertebral characters to the following species, but with the hæmal carina in the cervicals less strongly marked, and no lateral depression on the centrum. Limbs unknown.

This species was founded upon the evidence of a cervical vertebra from the Wealden of Germany; and there appears no sufficient reason for separating the dorsals from the same deposits described under the name of *Plesiosaurus degenhardti*.

Hab. Europe (Germany and England).

2446. The centrum of an anterior or middle cervical vertebra; from the Wealden of Cuckfield, Sussex. Length 0,035 (1·36 inches), height 0,032 (1·26 inches), width 0,037 (1·45 inches). Although of rather small dimensions this specimen agrees closely in proportions and character with the type cervical figured by Koken in the 'Pal. Abhandl.' vol. iii. art. 5, pl. ix. fig. 5. It presents a strong general resemblance to the middle cervicals of *C. portlandicus*, but has the hæmal carina much less prominent.

Mantell Collection. Purchased, 1838.

36530. An imperfect middle cervical vertebra of rather larger size; from Cuckfield. The lateral borders of the terminal faces have been worn away; the anterior face is distinctly cupped. *Mantell Collection. Purchased*, 1853.

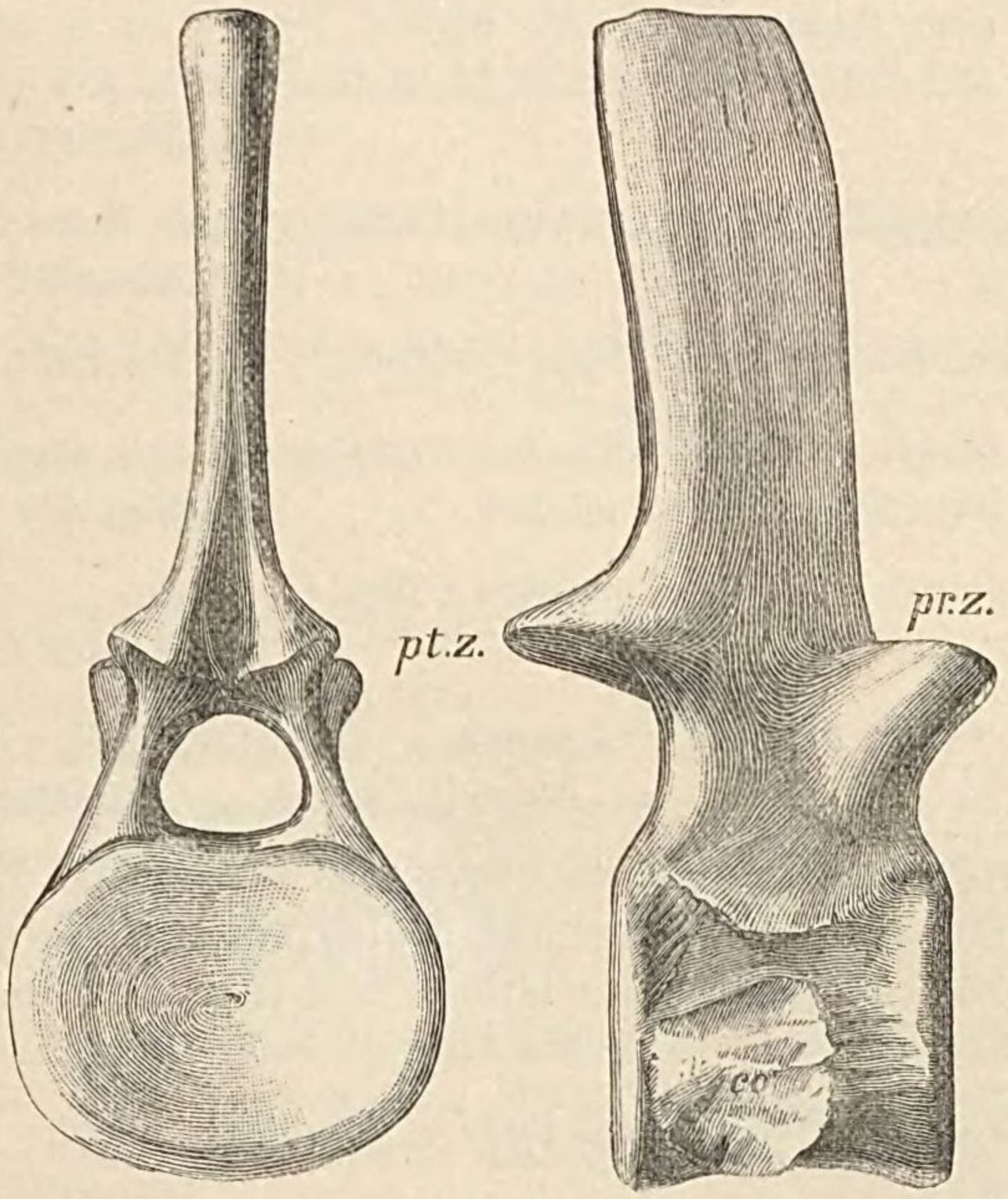
[1] Pal. Abhandl. vol. iii. art. 5, p. 109 (1887).—*Plesiosaurus.*
[2] *Loc. cit.* [3] *Ibid.* p. 106.

10842. An imperfect cervical vertebra somewhat later in the series; from Cuckfield. The neuro-central suture is completely obliterated, indicating maturity.

Mantell Collection. Purchased, 1838.

2429. (*Fig.*) A nearly entire later cervical vertebra; from Cuckfield. Length of centrum 0,035 (1·36 inches), height 0,035 (1·36 inches), width 0,048 (1·9 inches); the height from the base of the neural arch to the summit of the spine being 0,087 (3·45 inches). This specimen (woodcut, fig. 69)

Fig. 69.



Cimoliosaurus limnophilus.—Posterior and right lateral aspects of a cervical vertebra; from the Wealden of Cuckfield. ⅔. *co*, costal facet; *pr.z*, pre-, *pt.z*, postzygapophysis.

agrees closely with the cervical of *C. portlandicus*, No. 45904, and bears the same relative proportion to No. 36530 as is presented by No. 45904 to the middle cervicals of *C. portlandicus*. The posterior aspect of the arch shows the great curvature of the zygapophyses and the deep cleft on the additional articulation characteristic of the

group; and the height and breadth of the neural spine is also well exhibited. The neuro-central suture is obliterated. *Mantell Collection. Purchased*, 1838.

2517. The centrum of a very similar vertebra; from Cuckfield. *Mantell Collection.*

2442. The centrum of a posterior cervical vertebra, in a waterworn condition; from Cuckfield. The costal facet is connected by a ridge with the arch. *Mantell Collection.*

2440. The centrum of a dorsal vertebra agreeing in size with the preceding, and probably referable to the same species; from Cuckfield. This specimen is apparently indistinguishable from the dorsals figured by Koken in the 'Pal. Abhandl.' vol. iii. art. 5, pl. ix. figs. 1, 2, as *P. degenhardti*. *Mantell Collection.*

2435. An imperfect dorsal centrum of similar type; from Cuckfield. *Mantell Collection.*

2445. A similar specimen; from Cuckfield. *Mantell Collection.*

2448. A dorsal vertebra, with the neural spine and zygapophyses imperfect; from Cuckfield. *Mantell Collection.*

2432. The arch of a dorsal vertebra; from Cuckfield. *Mantell Collection.*

36530. A nearly entire dorsal vertebra; from Cuckfield. *Mantell Collection. Purchased*, 1853.

2441. An imperfect dorsal vertebra; from Cuckfield. This specimen strongly resembles the dorsals of *C. portlandicus*, having the same anterior overhang of the centrum. *Mantell Collection. Purchased*, 1838.

2439. The centrum of a dorsal vertebra; from Cuckfield. *Mantell Collection.*

2443. A similar specimen; from Cuckfield. *Mantell Collection.*

36536. The imperfect centrum of a dorsal vertebra; from Cuckfield. *Mantell Collection. Purchased*, 1853.

28521. The proximal portion of a humerus or femur probably belonging to this form; from the Wealden of Sussex. In the relatively small size and position of the trochanter this specimen differs widely from the propodial of *C. valdensis*. *Dixon Collection. Purchased*, 1851.

The following specimens may indicate larger individuals of this species.

2444. The centrum of a later cervical vertebra; from Cuckfield. (*Fig.*) Figured in Mantell's 'Fossils of Tilgate Forest,' pl. ix. fig. 4. *Mantell Collection.*

26000. A nearly similar specimen; from the Wealden.
Dixon Collection. Purchased, 1851.

R. 1311. A tooth in matrix, provisionally referred to this species; from Cuckfield. *Mantell Collection.*

Cimoliosaurus, sp.

Known only by the undermentioned specimen.
Hab. Europe (England).

21974. A small left propodial bone, wanting the distal extremity; from the Purbeck of Swanage, Dorsetshire. In its strongly developed trochanter this specimen closely resembles the humerus of *C. haasti*, on which ground it is provisionally placed in the present group. It may belong to the preceding species. *Purchased*, 1848.

Cimoliosaurus portlandicus (Owen [1]).

Syn. *Pliosaurus portlandicus*, Owen [2].
(?) *Cimoliosaurus biangulatus*, Cope [3].
(?) *Cimoliosaurus triangulatus*, Cope [4].
Plesiosaurus winspitensis, Seeley [5].
Plesiosaurus carinatus, Phillips [6].
Plesiosaurus phillipsi, Sauvage [7].

Of medium size. Centra of cervical vertebræ moderately elongated in the middle region, and shorter posteriorly, with their terminal faces somewhat cupped, having a distinct median pit, the lateral surfaces somewhat depressed, the hæmal foramina separated

[1] Reptilia of Kimeridge Clay (Mon. Pal. Soc.), pt. iii. p. 8 (1869).—*Pliosaurus.*
[2] *Loc. cit.*
[3] Trans. Amer. Phil. Soc. vol. xiv. pt. i., advance separate copy, p. 56 (1869), cancelled in subsequent issue (1870).
[4] *Ibid.* p. 42, *errorim.*
[5] Ann. Mag. Nat. Hist. ser. 4, vol. viii. p. 185 (1871).
[6] Geology of Oxford, p. 374 (1871).—Preoccupied by Cuvier, see p. 168.
[7] Ann. Sci. Nat., Zool. sér. 6, vol. viii. art. 6, p. 21 (1871). Also independently by Whidborne in Quart. Journ. Geol. Soc. vol. xxxvii., table facing p. 480 (1881).

by a prominent ridge, and the base of the neural canal hour-glass-shaped. Dorsals without hæmal ridge. Humerus and femur (fig. 70) long, and articulating distally with three bones.

This species was founded upon the undermentioned pelvic limb from the Portlandian of the Isle of Portland; vertebræ from the same beds, some of which probably belong to the same individual as the type, are identical with those from this locality described as *Plesiosaurus winspitensis*, and also with those from the Portlandian of Quainton, Buckinghamshire, to which the name *P. carinatus* was applied. *Cimoliosaurus biangulatus* was founded upon vertebræ from the Portlandian of Tisbury, Wiltshire, which are probably of the same type. The French specimens figured by Sauvage are likewise Portlandian.

Hab. Europe (England and France).

The following specimens are from the Portland Oolite (Upper Jurassic) of the Isle of Portland, Dorsetshire, and it is probable that a considerable number belong to a single individual.

41238. The imperfect centrum of a posterior cervical vertebra. The length is 0,030 (1·16 inches), the vertical diameter of the terminal face 0,032 (1·25 inches), and the transverse 0,041 (1·6 inches). It closely resembles the type cervical of *P. carinatus* figured in Phillips's 'Geology of Oxford,' p. 375, fig. 175, and agrees in relative size with the pelvic limb No. 40640. *Purchased*, 1868.

45904. The centrum of a larger posterior cervical vertebra. *Purchased*, 1876.

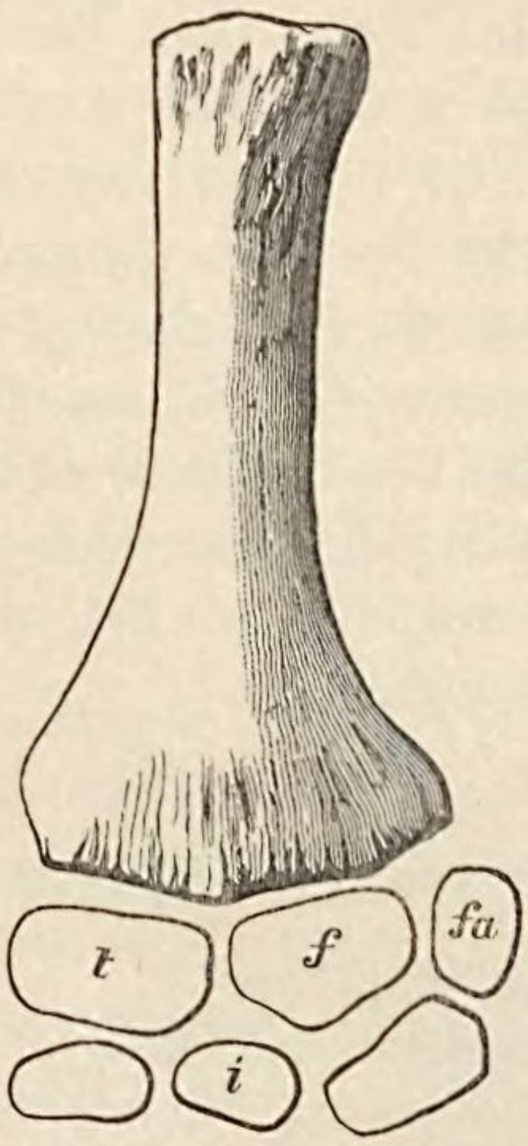
41238. Two nearly entire middle cervical vertebræ, cemented together by matrix. In the hinder one the nearly entire arch is preserved. The centrum is relatively longer than in the preceding specimens, its length being 0,039 (1·55 inches), and the height of the anterior face 0,038 (1·5 inches). These specimens, except for their somewhat smaller size, cannot be distinguished from the cervical from the same beds figured by Seeley in the 'Ann. Mag. Nat. Hist.' ser. 4, vol. viii. pp. 182, 183, under the name of *P. winspitensis*; showing the same forward overhang of the upper part of the centrum, the median pit in the terminal faces, and the inferior carina. The dimensions of the centrum of the above-mentioned specimen are:—length 0,051 (2 inches), height 0,048 (1·9 inches), and width 0,061 (2·4 inches). *Purchased.*

41238. Two imperfect posterior cervical vertebræ. *Purchased.*

R. 984. The centrum and base of the arch of a middle (?) cervical vertebra. The centrum has the same relative length as in the preceding specimens, but the costal facet is lower.
Presented by W. Davies, Esq., 1887.

41216. The imperfect centrum and fragment of the arch of an anterior (?) dorsal vertebra. The forward overhang of the upper part of the centrum is well shown. In relative size this specimen would agree with the type vertebra of *Plesiosaurus winspitensis*. *Purchased*, 1868.

Fig. 70.



Cimoliosaurus portlandicus.—Ventral aspect of the proximal portion of the right pelvic limb; from the Portland Oolite. *t*, tibia; *f*, fibula; *fa*, homologue of pisiform; *i*, intermedium; the two bones on the left and right of *i* are respectively the tibiale and fibulare; and there should be a fourth bone below *fa*. $\frac{1}{6}$.

R. 403. The imperfect centrum of a dorsal vertebra.
Presented by C. Westendarp, Esq., 1884.

41216 a. One lateral half of the centrum of a dorsal vertebra.
Purchased, 1868.

41216 b. The slightly imperfect centrum of a caudal vertebra.
Purchased, 1868

41405. The centrum of a caudal vertebra, with one face slightly broken. *Purchased*, 1869.

41217. The imperfect left scapula and coracoid, associated with No. 41216. So far as can be determined from these specimens the general structure of the pectoral girdle is the same as in other species. *Purchased*, 1868.

41215. The distal extremity and part of the shaft of a humerus or femur. This specimen was associated with No. 41217, and agrees in relative size with the following specimen.
Purchased, 1868.

40640. (*Fig.*) Slab exhibiting the ventral aspect of the proximal portion of the right pelvic limb. The type specimen. Figured by Owen in his 'Reptilia of the Kimeridge Clay,' pt. iii. pl. iv.; a reduced figure of the distal portion being given by Hulke in the 'Proc. Geol. Soc.' for 1883, p. 54, fig. 8, with a revised nomenclature of the component bones (*vide suprà*, p. 120). The close resemblance of this specimen (fig. 70) to the limb figured by Kiprijanoff in the 'Mém. Ac. Imp. St. Pétersbourg,' vol. xxxi. art. 6, pl. xix. fig. 1, as *Lutkesaurus* (*vide suprà*, p. 172), can leave no doubt as to the near alliance of their respective owners. This specimen is noticed by Seeley in the 'Ann. Mag. Nat. Hist.' ser. 4, vol. viii. p. 181, where its resemblance to *Plesiosaurus* is indicated. *Purchased*, 1867.

Cimoliosaurus truncatus, Lydekker (*ex* Owen [1]).

Syn. *Plesiosaurus truncatus*, Owen [2].
(?) *Plesiosaurus subdepressus*, Owen [3].
(?) *Plesiosaurus dædicomus*, Owen [4].
Plesiosaurus plicatus, Phillips [5] (*in parte*) and Sauvage [6].

Imperfectly known, but attaining very large dimensions. Apparently closely allied to the following species, but distinguished by its superior size, and by the circumstances that the length of the later cervical centra is on the average somewhat shorter, and the terminal faces are rather flatter.

The specific name was applied to the centrum of an immature cervical vertebra from the Kimeridge Clay of Oxfordshire; but it will be convenient to take as the types the series of cervicals in

[1] Cat. Foss. Rept. Mus. R. College of Surgeons, p. 59 (1854).—*Plesiosaurus.* Description insufficient.
[2] *Loc. cit.* [3] *Ibid.* p. 63.
[4] Rep. Brit. Assoc. for 1839, p. 81 (1840).
[5] Geology of Oxford, p. 374 (1871).
[6] Ann. Sci. Nat., Zool. sér. 6, vol. viii. art. 6, p. 25 (1879).

the Oxford Museum from the same locality, one of which is figured on p. 373 of Phillips's 'Geology of Oxford.'

It is not improbable that there is a complete transition from the smallest individuals of this form to the largest ones noticed under the head of *C. plicatus*, and there may be two species included under the present specific heading. It is highly probable that limb-bones of this species are included among those mentioned on pp. 147–151.

The specimens noticed by Sauvage are from the Kimeridgian of Boulogne.

Hab. Europe (England and France).

44636. The centra of two small immature cervical vertebræ; from the Kimeridge Clay of Weymouth. These specimens are scarcely distinguishable from the cervical of *C. plicatus*, No. R. 1282. *Purchased*, 1873.

44596. The centra of two rather larger associated cervical vertebræ; from the Kimeridge Clay of Swindon, Wiltshire. The cupping of the terminal faces is well marked, and the interforaminal space on the hæmal surface nearly flat; the arches were not anchylosed to the centrum.

Presented by the Directors of the Swindon Brick and Tile Company, 1876.

R. 1288. Cast of the centrum of a larger immature middle cervical vertebra. The original was obtained from the Kimeridge Clay of Shotover, near Oxford, and is preserved in the Oxford Museum. It is figured by Phillips on p. 374 as a variety of *C. plicatus*. The terminal faces are more decidedly cupped than is usually the case, but this can scarcely be regarded as a specific character.

Made in the Museum, 1888.

44902. An imperfect late cervical vertebra; probably from the Kimeridge Clay of Shotover. The arch is completely anchylosed. Length of centrum 0,064 (2·52 inches), height 0,063 (2·50 inches), width 0,082 (3·22 inches). This specimen closely resembles the type cervical figured by Phillips on p. 373.

Presented by Sir R. Owen, K.C.B., 1874.

20280. A very large posterior cervical vertebra, in a somewhat imperfect condition; from the Kimeridge Clay of Ely, Cambridgeshire. Length of centrum 0,080 (3·15 inches), height 0,079 (3·1 inches), width 0,100 (3·94 inches). The costal articulation is halfway up the side of the

centrum, and is connected with the arch by a vertical ridge. There is a very similar but rather smaller specimen from Shotover in the Oxford Museum. This specimen approaches closely to the cervicals of *Polyptychodon*.

Purchased, 1846.

41956. The centrum of a rather smaller and somewhat later cervical vertebra; from the Kimeridge Clay of Weymouth. On one side the costal facet is almost confluent with the neural facet, while on the other there is a considerable interval between the two. *Purchased*, 1870.

47169 x. The crushed centrum of a large posterior cervical vertebra, closely resembling the preceding specimen, but belonging to an adult animal; said to be from the Cornbrash of Stilton, Northamptonshire, but more probably from the Kimeridge Clay. Length 0,056 (2·22 inches), height 0,065 (2·55 inches), width 0,080 (3·15 inches).

Sharp Collection. Purchased, 1876.

R. 1400. The centrum of a large posterior cervical vertebra; probably a specimen derived from the Kimeridge Clay, locality unknown. This specimen has evidently been subjected to rolling. *No history.*

41776 a. The centrum of a rather smaller and later cervical vertebra of an immature individual; from the Kimeridge Clay of Ely. *Purchased*, 1869.

47422. The centrum of a posterior cervical vertebra; from the Kimeridge Clay of Ely. This specimen, in which the arches were anchylosed, closely resembles No. 41956. It exhibits a distinct forward overhang of the upper part of the centrum; and the costal articulations are connected by a ridge with the arches.

Sharp Collection. Purchased, 1876.

47421. Three imperfect anterior dorsal vertebræ associated with the preceding. The centra have transversely elliptical faces, with the hæmal surface flattened, and without foramina, and the sides constricted. Length of centrum 0,063 (2·50 inches), height 0,068 (2·68 inches), width 0,081 (3·2 inches). The arches are imperfect.

Sharp Collection.

42288. An imperfect later dorsal vertebra; from the Kimeridge Clay of the Isle of Portland, Dorsetshire. The general contour

of the centrum is very similar to that of No. 47421, but the length is relatively greater, as is shown by the following dimensions :—length 0,074 (2·9 inches), height 0,073 (2·78 inches), width 0,080 (3·15 inches). *Purchased*, 1869.

R. 1259. A very similar specimen ; from the Kimeridge Clay of Dorsetshire. The anterior face is somewhat more cupped than in the preceding. *No history.*

44819. The centrum of a very similar vertebra ; from the Kimeridge Clay, locality unknown.

Presented by B. Bright, Esq., 1873.

20280 a. A larger imperfect dorsal vertebra ; from the Kimeridge Clay of Ely. Not improbably associated with No. 20280.

Purchased, 1846.

47505. A very large dorsal vertebra ; from the Kimeridge Clay of Dorsetshire. The left transverse process and the summit of the neural spine are wanting. Length of centrum 0,085 (3·34 inches), height 0,099 (3·92 inches), width 0,096 (3·8 inches) ; distinct overhang is shown in the centrum. *Presented by J. C. Mansel-Pleydell, Esq.*, 1870.

R. 1260. A large posterior dorsal vertebra, provisionally referred to this species ; from the Kimeridge Clay of Shotover. The centrum is relatively shorter than in the preceding specimen, with the anterior face more deeply cupped, and the hæmal surface narrower and sharper. The transverse processes, of which the right is wanting, are also shorter.

No history.

R. 1261. An imperfect lumbar vertebra provisionally referred to this species ; from the Kimeridge Clay of Kimeridge Bay, Dorsetshire.

Presented by J. C. Mansel-Pleydell, Esq., 1888.

24684 c. The centrum of an immature dorsal vertebra ; from the Kimeridge Clay of Wootton-Bassett, Wiltshire. The hæmal surface has been crushed in.

Cunnington Collection. Purchased, 1849.

R. 273. A small and apparently immature propodial bone not improbably referable to this species ; from the Kimeridge Clay of Shotover. The type of *Plesiosaurus dædicomus*. Described by Owen in the 'Rep. Brit. Assoc.' for 1839, p. 81. The proximal extremity is decorticated.

Egerton Collection. Purchased, 1882.

Some or all of the following specimens may be specifically distinct.

44188. Two imperfect anterior (?) cervical vertebræ; from the Kimeridge Clay of Weymouth, Dorsetshire. In one specimen the greater part of the arch is preserved. In the other the dimensions of the centrum are:—length 0,056 (2·2 inches), height 0,046 (1·8 inches), width 0,057 (2·25 inches). *Purchased*, 1873.

33123. A similar imperfect cervical vertebra; from the Kimeridge Clay of Shotover, near Oxford. *Purchased*, 1859.

24803. An imperfect dorsal vertebra; from the Kimeridge Clay of Wootton-Bassett, Wiltshire. Length 0,062 (2·45 inches), height 0,060 (2·35 inches), width 0,069 (2·72 inches). *Cunnington Collection. Purchased*, 1849.

The following specimens are from the Neocomian bone-bed of Potton, Bedfordshire, and were doubtless derived from the Kimeridge Clay.

42032. The centrum of a dorsal vertebra. *Purchased*, 1870.

40442–3. Two centra of dorsal vertebræ of the same general type as the last, but more constricted laterally, and perhaps indicating a different species. *Purchased*, 1867.

Cimoliosaurus plicatus (Phillips [1]).

Syn. *Plesiosaurus plicatus*, Phillips [2].
Plesiosaurus infraplanus, Phillips [3].
(?) *Plesiosaurus hexagonalis*, Phillips [4].
Muræosaurus leedsi, Seeley [5].
Plesiosaurus leedsi, Whidborne [6].

Of medium size. Cervical vertebræ 44 in number; those of the anterior and middle region having the centra considerably elongated, with the length somewhat exceeding the height, but the posterior ones somewhat shorter; the terminal faces slightly cupped and without a median pit; and the hæmal foramina separated by a nearly flat surface, the terminal borders of the outer surface of the

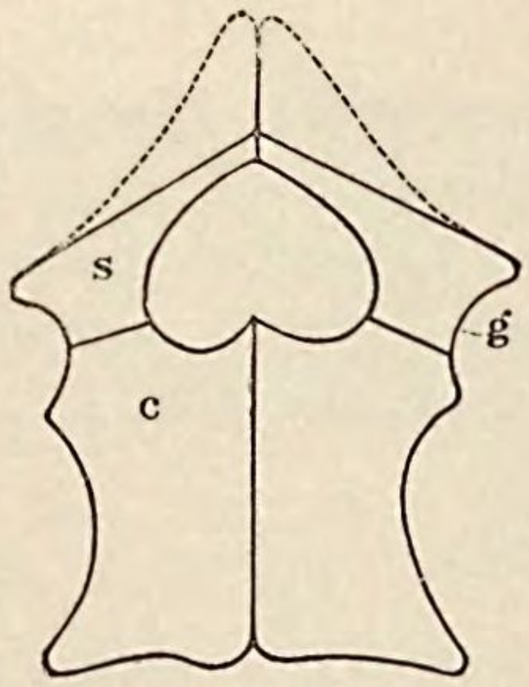
[1] Geology of Oxford, p. 313 (1871).—*Plesiosaurus.*
[2] *Loc. cit.* [3] *Ibid.* p. 374. [4] *Ibid.* p. 375.
[5] Quart. Journ. Geol. Soc. vol. xxx. p. 197 (1874).
[6] *Ibid.* vol. xxxvii. table facing p. 480 (1881).

vertebræ marked by distinct plications, which are especially prominent in immature examples. Humerus (fig. 71) articulating distally with only the radius and ulna; the former being elongated antero-posteriorly, and the latter comparatively short and wide; and there being a distinct interval between the two. In the humerus and femur the pre- and postaxial rough surfaces for cartilage at the distal extremity extend to an equal height.

This species was founded upon two imperfect cervical vertebræ (No. R. 1332), from the Oxford Clay.

The adult but somewhat crushed skeleton on which *Muræenosaurus leedsi* was founded (*infrà*, No. R. 1262) has cervical vertebræ of the same type. In that skeleton the pectoral arch is very imperfect, but another example, in the collection of A. N. Leeds, Esq. (No. 22), shows the bony bar connecting the ventral plates of the scapulæ with the coracoids; it appears that in the restoration given by Seeley in the 'Quart. Journ. Geol. Soc.' vol. xxx. p. 448, the dorsal portion of the scapula has been mistaken for the ventral plate[1]. The name *Plesiosaurus infraplanus* was applied to three centra of immature cervical vertebræ obtained from Brill, Stanford (Berkshire), and Shotover; at least the two first being certainly from the Oxford Clay, although described by Phillips among the Kimeridgian forms. These vertebræ are identical with cervicals of an immature skeleton (*infrà*, No. R. 1282) in the collection of Mr. Leeds. *Plesiosaurus hexagonalis* was founded upon a caudal vertebra from Cowley, which appears to be also of Oxfordian age, and is probably referable to the present species. It has been mentioned above (p. 209) that the pectoral girdle and limb, together with the dorsal vertebræ, figured

[1] See Geol. Mag. dec. 3, vol. v. pp. 351–352 (1888). The accompanying woodcut shows Seeley's restoration of the pectoral girdle; the bones marked *s*,

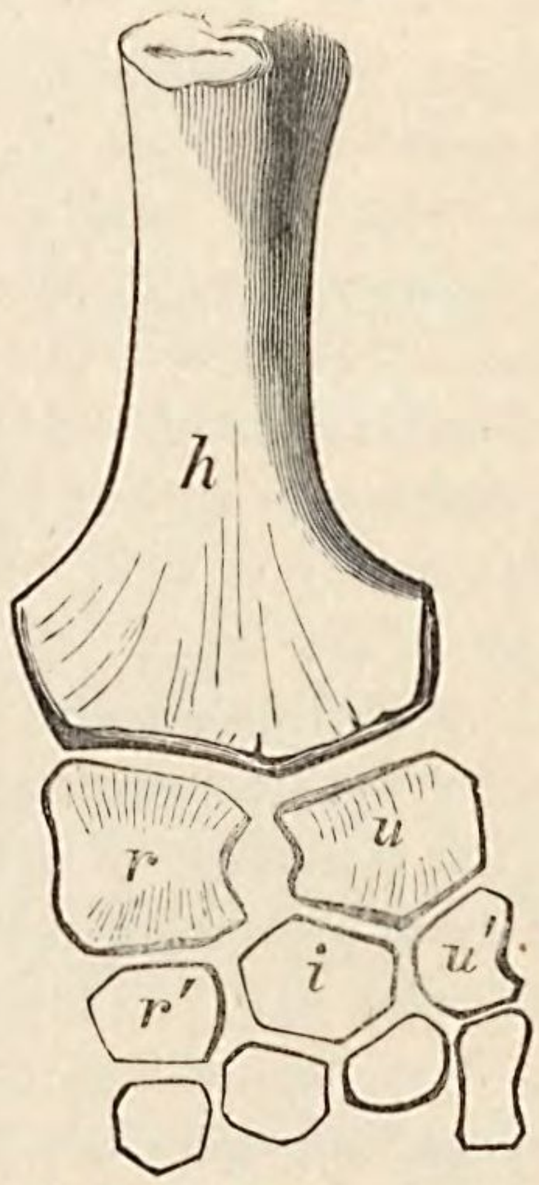


Restoration by Seeley of the pectoral girdle of *Cimoliosaurus plicatus*.

and made to meet in the middle line, being the dorsal portions of the scapulæ, which should really be widely separated; the median production of the coracoids (*c*) has been broken away.

by Phillips under the name of *Plesiosaurus oxoniensis* appear referable to the present species. The humerus of the above-mentioned specimen has a length of 0,292 (11·5 inches), and a diameter at the distal extremity of 0,177 (7 inches). The limb-bones of the undermentioned skeletons agree approximately in size with this humerus; but it is at present uncertain whether this species may not have attained larger dimensions. Thus an isolated femur from the Oxford Clay of Peterborough, in the collection of Mr. Leeds, agrees

Fig. 71.



Cimoliosaurus plicatus.—Dorsal aspect of part of the right pectoral limb; from the Oxford Clay. $\frac{1}{7}$. *h*, humerus; *r*, radius; *u*, ulna; *r'*, radiale; *i*, intermedium; *u'*, ulnare.

in contour with the corresponding bone of the present species, but has a length of 0,343 (13·5 inches). In an imperfect skeleton in the same collection (No. 26) indicating an allied form the limb-bones differ somewhat from those of typical examples of the present species; the humerus having a length of 0,339 (13·4 inches), and the femur of 0,327 (12·5 inches).

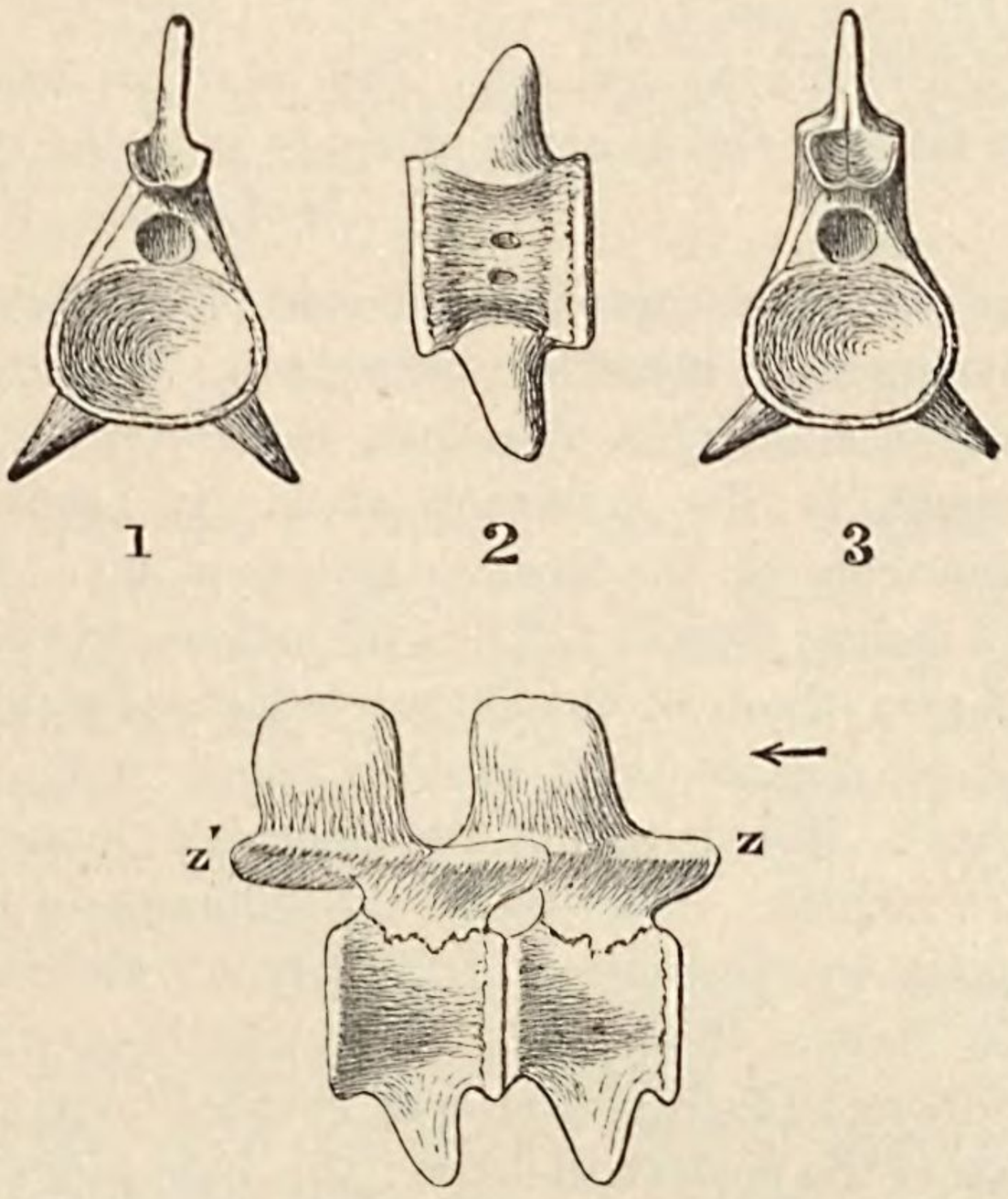
Hab. Europe (England).

R. 1332. Cast of an imperfect late cervical vertebra, probably about the 28th. The original (fig. 72) is one of the two types, and was obtained from the Oxford Clay of Oxfordshire. It is preserved in the Museum at Oxford, and is figured on p. 313 of Phillips's 'Geology of Oxford,' The dimensions

of the centrum are:—length 0,053 (2·1 inches), height 0,047 (1·85[1] inches), width 0,067 (2·65 inches). In the figure the neuro-central suture is a feature which is not shown in the original, and the neural spines would have been much higher if the specimens were perfect.

Made in the Museum, 1888.

Fig. 72.



Cimoliosaurus plicatus.—Posterior (1), hæmal (2), and anterior (3) aspects of a late cervical vertebra, and right lateral aspect of two such vertebræ; from the Oxford Clay of Oxfordshire. $\frac{1}{5}$. *z*, pre-, *z'*, postzygapophysis. (*After Phillips.*)

R. 1262. Casts of the imperfect 33rd cervical and 3rd caudal vertebræ. The originals belong to the type skeleton of *Muræosaurus leedsi*, obtained from the Oxford Clay of Peterborough, Northamptonshire, and preserved in the collection (No. 21) of A. N. Leeds, Esq., of Eyebury, near that town. The cervical is figured by Seeley in the 'Quart. Journ. Geol. Soc.' vol. xxx. pl. xxi. fig. 2. The centrum has been crushed, so that its height and width cannot be determined; but the length is 0,054 (2·12 inches). In the 39th cervical represented in fig. 3 of the

[1] Given by Phillips as 2·0 inches.

same plate the dimensions of the centrum are:—length 0,051 (2·0 inches), height 0,050 (1·98 inches), width 0,065 (2·55 inches); which agree very closely with those of the type. In the caudal, which is figured by Seeley, *op. cit.* figs. 4, 5, the length is 0,038 (1·5 inches), height 0,039 (1·55 inches), and width 0,054 (2·1 inches); the anchylosed chevrons are broken off. The length of the associated humerus is 0,253 (10 inches). In another adult skeleton in the same collection (No. 22) the length of the humerus is 0,290 (11·45 inches). The later cervical vertebræ of the latter skeleton agree precisely with the types.

Made in the Museum, 1888.

R. 1282. Casts of the centra of an anterior and a posterior cervical vertebra of an immature individual. The originals belong to a skeleton (No. 23) from the Oxford Clay of Peterborough in the collection of A. N. Leeds, Esq. The dimensions of the smaller specimen are:—length 0,043 (1·7 inches), height 0,035 (1·37 inches), width 0,042 (1·65 inches); those of the larger being:—length 0,053 (2·1 inches), height 0,042 (1·65 inches), width 0,062 (2·44 inches). The length of the associated humerus is 0,271 (10·7 inches). Allowing for the difference of age and serial position the dimensions of the larger vertebra accord well with those of the types. The immature cervicals on which *Plesiosaurus infraplanus* was founded precisely resemble those of the present skeleton; the dimensions of the specimen from Brill are:—length 0,045 (1·79 inches), height 0,046 (1·82 inches), and width 0,052 (2·03 inches).

Same history.

48002. A very early cervical vertebra; from the Oxford Clay near Oxford. Length 0,029 (1·14 inches), height 0,025 (0·95 inch), width 0,030 (1·2 inches).

Presented by the Hon. R. Marsham, 1877.

44187. The associated centra of four immature cervical vertebræ; from the Oxford Clay of Weymouth, Dorsetshire.

Purchased, 1873.

48001. The centrum of a small and malformed cervical vertebra; from the Oxford Clay near Oxford. This specimen is immature; and on one side is divided into two portions, each with its distinct costal facet.

Presented by the Hon. R. Marsham, 1877

36137. The associated centra of four posterior cervical and one "pectoral" vertebræ; from the Lower Oxford Clay of Chippenham, Wiltshire. The dimensions of the best preserved cervical are:—length 0,042 (1·92 inches), height 0,059 (2·35 inches), width 0,074 (2·94 inches); these measurements having nearly the same proportions as in the 44th cervical associated with No. R. 1262, described by Seeley, *op. cit.* p. 203. *Purchased*, 1861.

47417. Seven associated vertebræ, mostly imperfect; from the Oxford Clay of Whittlesea, near Peterborough. These specimens comprised two late cervicals, three "pectorals," and two anterior dorsals. In one of these "pectorals" the arch, with the exception of the zygapophyses, is entire. The dorsals agree exactly with No. R. 1281 (*infrà*).

Sharp Collection. Purchased, 1876.

47880. Two nearly entire "pectoral" and one anterior dorsal vertebra; from the Oxford Clay near Oxford. In one of the "pectorals" the dimensions of the centrum are:—length 0,058 (2·3 inches), height 0,054 (2·15 inches), width 0,076 (3·0 inches). The forward overhang of the upper part of the centrum is strongly marked. These indicate a large individual.

Presented by the Hon. R. Marsham, 1877.

R. 1280. Five associated dorsal vertebræ, in a somewhat imperfect condition; from the Oxford Clay of Peterborough. In the best preserved example the dimensions are:—length 0,052 (2·05 inches), height 0,056 (2·2 inches), and width 0,063 (2·48 inches); with a height of about 0,127 (5·0 inches) from the base of the neural canal to the summit of the spine. These specimens agree precisely with the dorsals of the skeleton No. 22 (*suprà*, p. 238), in the possession of the donor.

Presented by A. N. Leeds, Esq., 1888.

R. 1281. Two somewhat imperfect associated dorsal vertebræ; from the Oxford Clay of Peterborough.

Presented by A. N. Leeds, Esq., 1888.

16045. The centrum of a somewhat larger dorsal vertebra belonging either to the present or a closely allied species; from the Oxford Clay of Peterborough. *Purchased. About* 1840.

47881. The centrum of a small immature dorsal vertebra; from the Oxford Clay near Oxford.

Presented by the Hon. R. Marsham, 1877.

47425. (*Fig.*) The right humerus; from the Oxford Clay of Northamptonshire. This specimen closely accords with the corresponding bone of the skeleton of No. R. 1262, its length being 0,267 (10·5 inches), and the width of the distal extremity 0,155 (6·1 inches). It has been employed, together with Nos. 47416 and R. 1289, in the figure of the pectoral limb (p. 236), of which the general outline was taken from the crushed paddle of the type skeleton. The equality in the height of the pre- and postaxial surfaces for the attachment of cartilage at the distal extremity is well shown; and of itself serves to distinguish this bone from the smaller humeri of the *C. trochanterius* type.

Sharp Collection. Purchased, 1876.

47416. A radius; from the Oxford Clay of Peterborough. Agrees with the corresponding bone of the above-mentioned skeleton.

Sharp Collection.

R. 1289. An ulna; from the Oxford Clay of Peterborough. This specimen exactly resembles the corresponding bone in the skeletons in the collection of the donor.

Presented by A. N. Leeds, Esq., 1888.

R. 1290. A fibula belonging either to a larger individual of this species or to an allied form; from Peterborough.

Presented by A. N. Leeds, Esq., 1888.

47431. An ischium of a young individual which may perhaps belong to this species; from the Oxford Clay of Whittlesea.

Sharp Collection.

Cimoliosaurus richardsoni, Lydekker (n. sp.).

Syn. *Plesiosaurus plicatus*, Mansel-Pleydell [1].

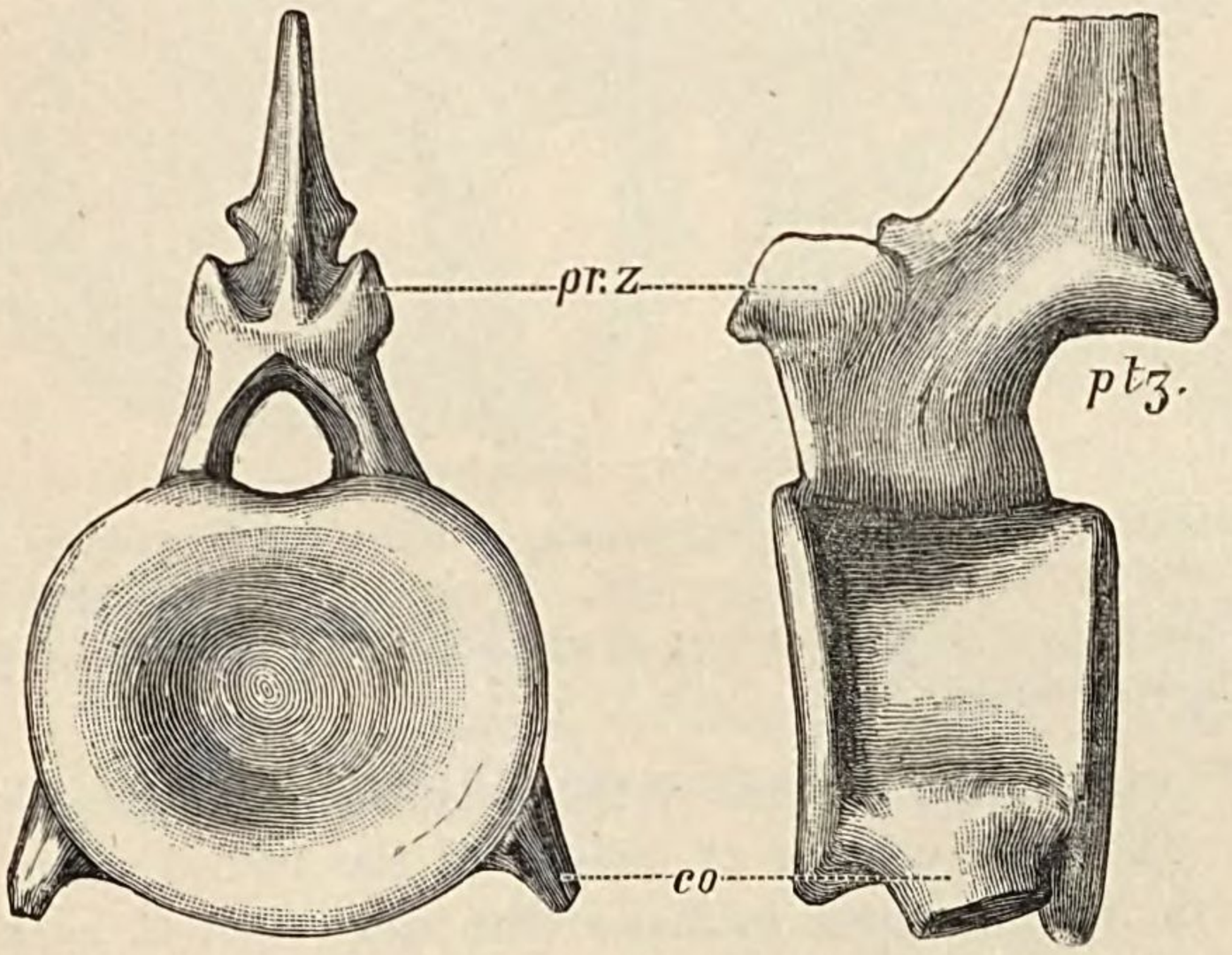
Of the approximate size of the preceding; but the cervical vertebræ shorter, with flatter terminal faces, and about 31 or 32 in number. In the middle cervicals the length of the centrum is somewhat less than the height. The number of cervical vertebræ is taken from an immature skeleton from the Oxford Clay in the collection of A. N. Leeds, Esq., of Eyebury, near Peterborough, which appears to be specifically identical with No. R. 1283. In the skeleton of No. R. 1263 the number of cervicals is given by Mansel-Pleydell as 35, but it is probable that this includes "pectorals."

Hab. Europe (England).

[1] Proc. Dorset. Nat. Hist. Club, vol. ix. table facing p. 40 (1888).

R. 1263. Casts of an associated imperfect middle (?) cervical and anterior caudal vertebræ. The originals belong to a nearly entire skeleton obtained from the Oxford Clay of Weymouth, Dorsetshire, in the possession of Nelson Richardson, Esq., of Montevideo, near Weymouth, which is the type of the species, and is noticed by Mansel-Pleydell in the 'Proc. Dorset. Nat. Hist. Club,' vol. ix. table facing p. 40 (1888), under the name of *Plesiosaurus plicatus*. The cervical vertebra (fig. 73) has lost the summit of the neural spine and the extremities of the ribs, and the centrum has its terminal faces somewhat expanded through pressure. The dimensions of the centrum are:—length 0,041 (1·57 inches), height 0,050 (1·95 inches), width 0,062 (2·45 inches). The relative length of the centrum is much less than in any of the cervicals of the above

Fig. 73.

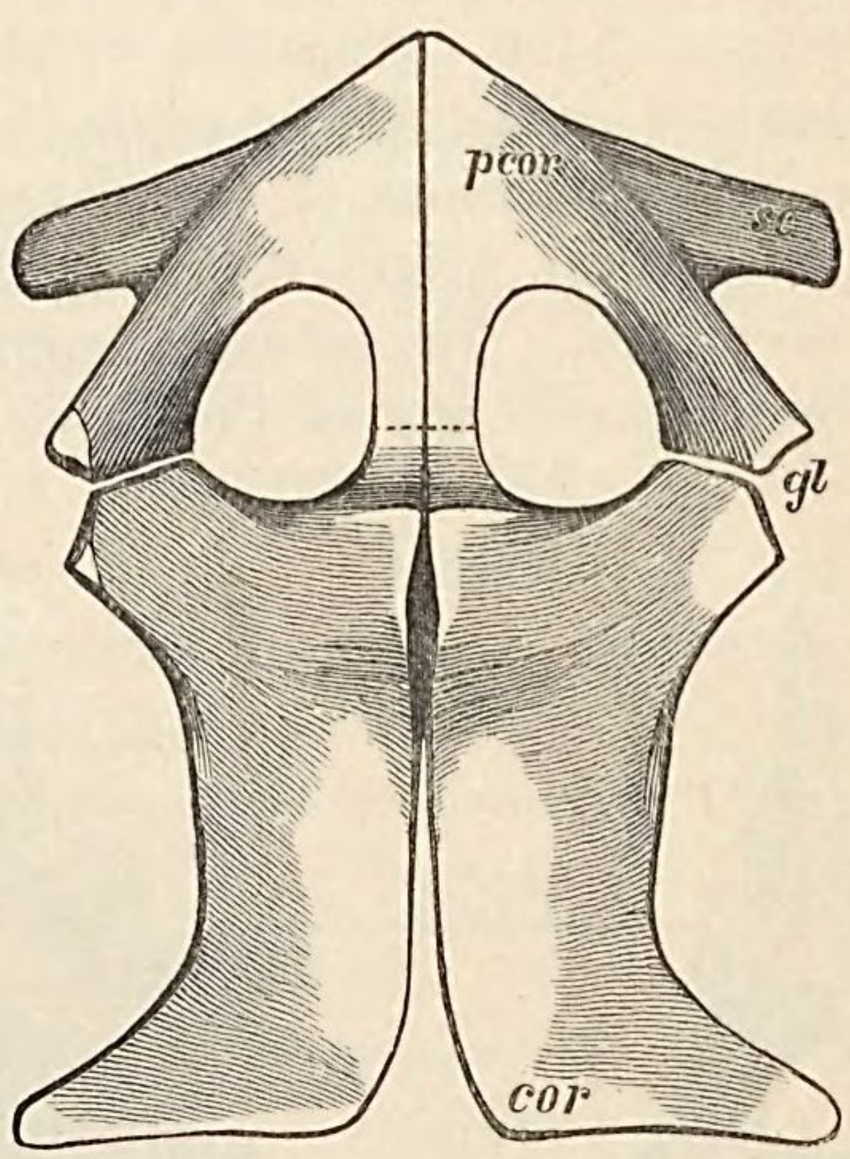


Cimoliosaurus richardsoni.—Anterior and left lateral aspects of a cervical vertebra; from the Oxford Clay of Weymouth. ½. *co*, rib; *pr.z*, pre-, *pt.z*, postzygapophysis.

mentioned skeletons of *C. plicatus*; and the complexity of the zygosphenal articulation so characteristic of this group is well shown. The caudal has been somewhat distorted by pressure; it shows the nearly entire chevrons anchylosed to the centrum. It is somewhat larger and relatively shorter than the caudal of *C. plicatus*, No. R. 1262 (p. 237), but has the same general structure. The restored pectoral girdle associated with these vertebræ is shown in fig. 74. *Made in the Museum*, 1888.

R. 1283. Cast of a smaller middle (?) cervical vertebra. The original belongs to an imperfect skeleton (No. 41) from the Oxford Clay of Peterborough, Northamptonshire, in the collection of A. N. Leeds, Esq., of Eyebury, near that town. The dimensions of the centrum are :—length 0,040 (1·56 inches), height 0,043 (1·68 inches), and width 0,053 (2·08 inches); the height from the base of the neural

Fig. 74.



Cimoliosaurus richardsoni.—Ventral aspect of the restored pectora girdle; from the Oxford Clay of Weymouth. About $\frac{1}{10}$. *sc*, scapula; *p.cor*, ventral (precoracoidal) plate of do.; *gl*, glenoid cavity. The shaded portions are those preserved.

canal to the summit of the spine being 0,102 (4 inches). The relatively great height of the neural spine is in marked contrast to that of the cervical of *C. eurymerus*, No. R. 1284 (p. 206). As in the preceding specimen the whole of the sutures are obliterated.

Made in the Museum, 1888.

47426. The centrum of an immature dorsal vertebra probably referable to this species; from the Oxford Clay of Whittlesea, near Peterborough. This specimen is relatively shorter than in the dorsals of *C. plicatus*, in which respect it agrees with those associated with No. R. 1263.

Sharp Collection. Purchased, 1876.

47426 a. Two smaller dorsal centra of similar type; from Whittlesea.

Sharp Collection.

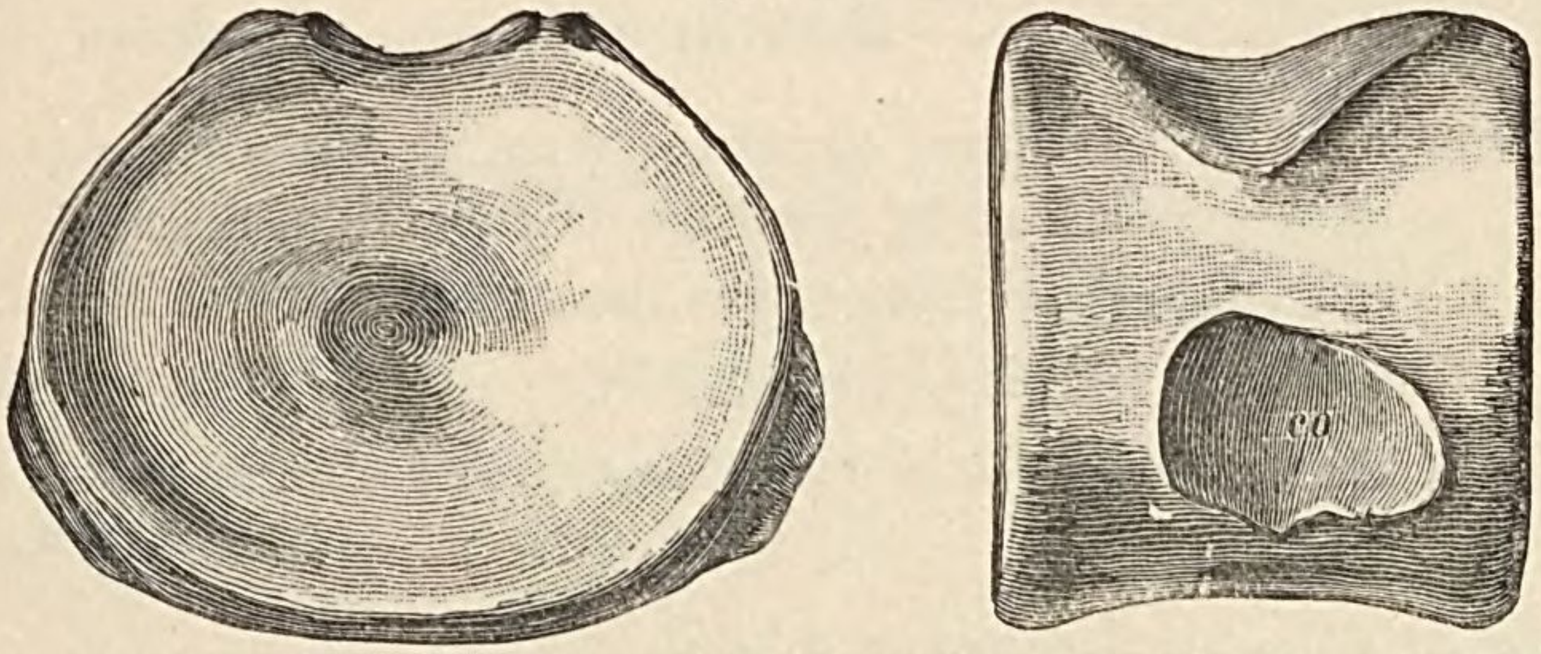
Cimoliosaurus brevior, Lydekker, n. sp.

A provisional species based on cervical vertebræ, which are relatively shorter than in *C. truncatus*, but not so short as in *C. richardsoni*.

Hab. Europe (England).

41955. (*Fig.*) The centra of six associated immature middle cervical vertebræ; from the Kimeridge Clay of Weymouth, Dorsetshire. These specimens are the types. The dimensions of the specimen represented in the accompanying woodcut are:—length 0,041 (1·57 inches), height 0,046 (1·74 inches), width 0,059 (2·35 inches). Smaller vertebræ from the Oxford Clay in the collection of Mr. Leeds show similar proportions. *Purchased*, 1870.

Fig. 75.



Cimoliosaurus brevior.—Anterior and left lateral aspects of the centrum of an immature cervical vertebra; from the Kimeridge Clay of Weymouth. ⅔.
co, costal facet.

41776. The centra of a middle and a posterior cervical and of a "pectoral" vertebra, probably specifically identical with the preceding; from the Kimeridge Clay of Weymouth. *Purchased*, 1869.

Specifically Undetermined Specimens.

32410. The centrum of an immature "pectoral" vertebra; from the Kimeridge Clay of Boulogne, France. This centrum is short and has a prominent hæmal ridge. *Purchased*, 1857.

47169. An imperfect associated cervical and "pectoral" vertebra; from the Cornbrash (Lower Jurassic) of Stilton, Northamptonshire. These specimens belong to a small but adult individual, and have the centrum of medium length. *Sharp Collection. Purchased*, 1876.

32702. The imperfect centrum of a late cervical vertebra; from the Oxford Clay of Vaches-Noires (Calvados), France. *Tesson Collection. Purchased*, 1857.

47169 a. The centrum of a large cervical vertebra; from the Cornbrash of Stilton. The centrum is elongated, and the specimen seems to indicate a species closely allied to *C. plicatus*. *Sharp Collection.*

47169 b. The centrum of a later immature cervical vertebra; from Stilton. This specimen is relatively rather shorter than the posterior cervicals No. 36173 (p. 239) of *C. plicatus*. *Sharp Collection.*

32719. The centra of three small and immature associated dorsal vertebræ; from the Oxford Clay of Vaches-Noires. The shortness of the centra suggests reference to *C. plicatus*. *Tesson Collection.*

27488. A similar specimen; from Vaches-Noires. *Hastings Collection. Purchased*, 1855.

47169 c. An anterior dorsal vertebra, wanting the greater portion of the neural arch; from the Cornbrash of Stilton. This specimen closely resembles the anterior dorsal No. 47880 (p. 239), referred to *C. plicatus*. *Sharp Collection.*

47169 d. An imperfect later dorsal vertebra of similar type; from Stilton. *Sharp Collection.*

47169 e. An imperfect dorsal vertebra of the same general type; from Stilton. *Sharp Collection.*

47169 f. The centrum of an immature anterior caudal vertebra; from Stilton. Accords very closely with the caudal of *C. richardsoni*, No. R. 1263 *a*. Neither the ribs nor chevrons were anchylosed. *Sharp Collection.*

47169 g. A rolled caudal centrum of similar type; from Stilton. *Sharp Collection*

Cimoliosaurus, sp.

Very imperfectly known. Of the approximate dimensions of *C. truncatus*, to which it may be very closely allied.

Hab. Europe (France and (?) England).

32718. Two associated imperfect cervical vertebræ; from the Inferior Oolite (Lower Jurassic) of Harcourt (Eure), France. These specimens comprise a middle and a posterior cervical. The dimensions of the former are:—length 0,068

(2·67 inches), height 0,053 (2·1 inches), width 0,075 (2·95 inches). Its contour closely resembles that of the cervicals of *C. truncatus*.

Tesson Collection. Purchased, 1857.

R. 256. An imperfect "pectoral" vertebra, which may belong to a smaller individual of the same form as the preceding; from the Great Oolite (Lower Jurassic) of Oxfordshire.

Egerton Collection. Purchased, 1882.

44904. The greater portion of a mandible which is not improbably specifically identical with the preceding; from the Great Oolite of Essendine, near Stamford, Lincolnshire. The symphysis is entire and of the usual shortness, but the crowns of the teeth are broken off.

Presented by Sir R. Owen, K.C.B., 1874.

Cimoliosaurus (**?**) sp.

(*Cf. Plesiosaurus erraticus*, Phillips[1].)

The undermentioned specimens indicate a much smaller form than the preceding, for which, if it proves distinct from all the Liassic species of *Plesiosaurus*, the above specific name may be adopted.

Hab. Europe (England).

R. 272. An imperfect anterior or middle cervical vertebra; from the Stonesfield Slate (Lower Jurassic) of Stonesfield, Oxfordshire. *Egerton Collection. Purchased*, 1882.

47995. A nearly entire "pectoral" vertebra; from Stonesfield. The anchylosis of the arch to the centrum indicates maturity.

Presented by the Hon. R. Marsham, 1877.

31818. A right humerus, agreeing in relative size with the preceding; from Stonesfield. *Purchased*, 1859.

Serial Position Uncertain.

Cimoliosaurus hoodi (Owen[2]).

Syn. *Plesiosaurus hoodi*, Owen[3].

Described on the evidence of a single cervical vertebra.

Hab. New Zealand.

[1] Geology of Oxford, p. 183 (1871).—No description.
[2] Geol. Mag. dec. 1, vol. vii. p. 53 (1870).—*Plesiosaurus*.
[3] *Loc. cit.*

47345 a. Cast of a cervical vertebra. The original was obtained from the Cretaceous of Waipara, South Island, New Zealand, and is preserved in the Museum at Wellington. It is the type, and is figured by Owen in the 'Geol. Mag.' dec. 1, vol. vii. pl. iii. figs. 1–3, and also by Hector in the 'Trans. N. Zealand Inst.' vol. vi. pl. xxviii. fig. B. The terminal faces of the centrum are somewhat cupped.
Presented by the Director of the Wellington Museum, 1876.

47345. Cast of an imperfect "pectoral" vertebra, perhaps belonging to the present species. The original was obtained from the same locality as the preceding, and is likewise preserved in the Wellington Museum.
Presented by the Director of the Wellington Museum, 1876.

GENUS *non det.*

R. 1473. Casts of two fragments containing four phalangeals, probably belonging to a Sauropterygian. The originals were obtained from the Cretaceous of Hundorf, Bohemia, and are preserved in the Museum at Prague.
Purchased, 1888.

LIST OF SPECIFIC NAMES APPLIED TO POST-LIASSIC FORMS NOT MENTIONED ABOVE.

It is probable that a considerable number of the following names are synonyms of the species mentioned above, but some may be generically distinct. Those that must be reckoned as purely MS. names have an asterisk prefixed.

a. *From the Cambridge Greensand.*

**Plesiosaurus cycnodirus*, Seeley [1].
**Plesiosaurus microdirus*, Seeley [2].
**Plesiosaurus euryspondylus*, Seeley [3].
**Plesiosaurus platydirus*, Seeley [4].
**Plesiosaurus ophiodirus*, Seeley [5].
**Plesiosaurus pœcilospondylus*, Seeley [6].

[1] Index to Aves &c. in Cambridge Museum, p. xvii (1869).
[2] *Ibid.* p. xviii. [3] *Loc. cit.* [4] *Loc. cit.*
[5] *Loc. cit.* [6] *Loc. cit.*

b. *From the Cretaceous of North America.*

Cimoliosaurus grandis, Leidy [1].
Syn. *Brimosaurus grandis*, Leidy [2].
Polycotylus latipinnis, Cope [3].
Elasmosaurus orientalis, Cope [4].
Oligosomus grandævus, Leidy [5].
Plesiosaurus gulo, Cope [6].
Plesiosaurus lockwoodi, Cope [7].
Uronautes cetiformis, Cope [8].
Orophosaurus pauciporus, Cope [9].
Piptomerus megaloporus, Cope [10].
Piptomerus microporus, Cope [11].
Piptomerus hexagonus, Cope [12].
Trinacromerum bentonianum, Cragin [13].

c. *From the Cretaceous of Australia.*

**Plesiosaurus macrospondylus*, M'Coy [14].
**Plesiosaurus sutherlandi*, M'Coy [15].

d. *From the Cretaceous of New Zealand.*

Plesiosaurus holmesi, Hector [16].
Plesiosaurus traversi, Hector [17].
Plesiosaurus mackayi, Hector [18].
Mauisaurus latibrachialis, Hector [19].

e. *From the Greensand of Russia.*

Spondylosaurus fahrenkohli, Fischer [20].
**Plesiosaurus nordmanni*, Eichwald [21].

[1] Proc. Ac. Nat. Sci. Philad. 1854, p. 72.—*Brimosaurus.* [2] *Loc. cit.*
[3] Trans. Amer. Phil. Soc. vol. xiv. art. 1, p. 36 (1870). [4] *Ibid.* p. 55.
[5] Proc. Ac. Nat. Sci. Philad. 1872, p. 39.—See also Rep. U.S. Geol. Surv. Terr. vol. i. p. 286 (1873).
[6] Rep. U.S. Geol. Surv. Terr. vol. ii. p. 88 (1875).
[7] Quoted *loc. cit.*
[8] Proc. Ac. Nat. Sci. Philad. for 1876, p. 346 (1876).
[9] Amer. Nat. vol. xxi. p. 565 (1887).
[10] *Ibid.* p. 564. [11] *Ibid.* p. 565. [12] *Loc. cit.*
[13] Amer. Geol. vol. ii. p. 405 (1888).
[14] Daintree, Quart. Journ. Geol. Soc. vol. xxviii. p. 278 (1872).
[15] *Loc. cit.*
[16] Trans. N. Zealand Inst. vol. vi. p. 344 (1874).
[17] *Loc. cit.* [18] *Ibid.* p. 345. [19] *Ibid.* p. 350.
[20] Bull. Soc. Mosc. vol. xix. pt. iii. p. 103 (1846).
[21] Quoted by Whidborne in the Quart. Journ. Geol. Soc. vol. xxxvii, table facing p. 480, with an incorrect reference.

f. *From the Portlandian of France.*

Plesiosaurus suprajurensis, Sauvage [1].
Syn. *Pliosaurus suprajurensis*, Sauvage [2].

g. *From the Kimeridgian of France.*

Hæmatosaurus lanceolatus, Sauvage [3].
Polycotylus suprajurensis, Sauvage [4].
Plesiosaurus morinicus, Sauvage [5].
Colymbosaurus dutertrei, Sauvage [6].

h. *From various Continental Jurassic Beds.*

**Plesiosaurus pentagonus*, Cuvier [7].
**Plesiosaurus* (?) *trigonus*, Cuvier [8].
Plesiosaurus suevicus, Quenstedt [9].

Genus **ERETMOSAURUS,** Seeley [10].

Allied in the characters of the axial skeleton and limbs to *Plesiosaurus*, from which it is chiefly distinguished by the pectoral girdle. In the latter (fig. 76) the coracoids are not produced in advance of the glenoid cavity; the scapulæ are very large, meeting in the middle line, and articulating by their whole width with the coracoids, leaving only a minute coracoidal foramen; omosternum present, fused with the ventral plates of the scapulæ, which may also anchylose with the coracoids [11].

In the type species the radius and ulna are elongated and separated by a wide interval, and neither the ulna nor fibula are reniform.

The accompanying figure shows the pectoral girdle as restored by

[1] Ann. Sci. Nat., Zool. sér. 6, vol. viii. art. 6, p. 12 (1879).—*Pliosaurus*; referred to *Plesiosaurus* in Bull. Soc. Géol. France, sér. 3, vol. viii. p. 545.

[2] *Loc. cit.*

[3] Mém. Soc. Géol. France, sér. 2, vol. x. art. 2, p. 53 (1874); referred to Sauropterygia in Bull. Soc. Géol. France, *op. cit.* p. 545.

[4] Ann. Sci. Nat., Zool. *op. cit.* p. 23 (1879).

[5] *Ibid.* p. 23. [6] *Ibid.* p. 29.

[7] Ossemens Fossiles, 2nd ed. vol. v. pt. ii. p. 486 (1824). [8] *Loc. cit.*

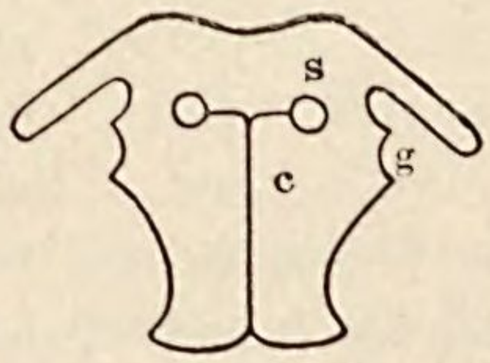
[9] Die Jura, p. 216 (1858).

[10] Quart. Journ. Geol. Soc. vol. xxx. p. 445 (1874).

[11] See also Tate and Blake, 'The Yorkshire Lias,' pl. i. fig. 7 (1876).

Seeley ; another pectoral girdle figured by the same writer in the 'Quart. Journ. Geol. Soc.' vol. xxx. p. 446, as referable to this genus, is noticed under the head of *Plesiosaurus* (p. 277). The contour of the anterior border of the pectoral girdle is suggestive of affinity with *Thaumatosaurus*.

Fig. 76.



Eretmosaurus rugosus.—Diagram of the pectoral girdle; from the Lower Lias. Greatly reduced. *s*, scapula; *c*, coracoid; *g*, glenoid cavity. (From the 'Quart. Journ. Geol. Soc.')

This genus is represented in the Upper Lias by *Plesiosaurus dubius*, Blake [1], which is probably identical with *P. macropterus*, Seeley [2].

Eretmosaurus rugosus (Owen [3]).

Syn. *Plesiosaurus rugosus*, Owen [4].

The type species; of medium size. Skull unknown, but (judging from the size of the anterior cervical vertebræ) probably small. About 35 cervical vertebræ, in which the centra are of medium length, with ellipsoidal and moderately cupped terminal faces and double costal facets. External surface of vertebræ and limb-bones extremely rugose; the rugosities at the end of the centra forming a kind of network. Radius and ulna much elongated, and carpals and tarsals very large; four bones in distal row of carpus and tarsus.

This species was founded upon vertebræ in the Museums at Bristol and York, and in the collection of the Earl of Enniskillen (Viscount Cole). The Upper Liassic specimens probably belong to a distinct species. Although the vertebræ of the undermentioned specimens are more rugose than those of any species of *Plesiosaurus*, it does not appear absolutely certain that they are identical with the types, in which case the species must date from the description

[1] Tate and Blake, *loc. cit.* p. 246.
[2] Ann. Mag. Nat. Hist. ser. 3, vol. xv. p. 50 (1865).
[3] Rep. Brit. Assoc. for 1839, p. 82 (1840).—*Plesiosaurus*.
[4] *Loc. cit.*

of the undermentioned skeleton. In describing the latter, the bone figured as the pisiform is really the broken extremity of the ulna, the corresponding bone in the pelvic limb being that of the fibula.

Hab. Europe (England).

14435. (*Fig.*) Slab showing the ventral aspect of the nearly entire skeleton, wanting the skull; from the Lower Lias near Granby, Nottinghamshire. Described and figured by Owen in his 'Liassic Reptilia' (Mon. Pal. Soc.), pt. iii. p. 34, pls. xiv., xv. (1865); and a restoration of the pectoral girdle given by Seeley in the 'Quart. Journ. Geol. Soc.' vol. xxx. p. 445, fig. 9 (reproduced in fig. 76). A large number of the vertebræ have been displaced, and several of them have been thrown upon the pectoral girdle, which is thus considerably obscured. In the anterior cervical vertebræ the ribs are anchylosed to the centra, but in the hinder part of the series they are separate. The effects of pressure have caused the division of the costal facets to be very indistinct.

Presented by His Grace the Duke of Rutland, K.G., 1841.

2051*. Eleven inperfect associated cervical vertebræ; from the Lower Lias, locality unknown. These specimens clearly show the division of the costal facets; the rugosity is very strongly marked, and there is a prominent hæmal ridge, as in the cervical of the preceding specimen figured by Owen, *op. cit.* pl. xv.

Hawkins Collection. Purchased, 1834.

2053*. An imperfect later cervical vertebra; from the Lower Lias of Lyme-Regis, Dorsetshire. The terminal faces have become more ellipsoidal and somewhat less cupped than in the preceding specimen, and the hæmal ridge is somewhat more prominent. The dimensions of the centrum are:—length 0,042 (1·65 inches), height 0,044 (1·73 inches), width 0,053 (0,021 inches). *Hawkins Collection.*

44158. A series of six imperfect caudal vertebræ provisionally referred to this species; from the Lower Lias of Cheltenham, Gloucestershire. These specimens, which have lost their neural spines and ribs, appear to agree very closely with the caudals of No. 14453. The terminal faces are somewhat quadrangular and rather deeply cupped, and the

external surface is markedly rugose. In the more anterior specimens the chevron-facets are confined to the posterior border, but in the hinder vertebræ they occur on both borders. *Purchased*, 1873.

Eretmosaurus (?) sp.

The following vertebræ are provisionally referred to this genus, and indicate a larger form than the type.

Hab. Europe (England).

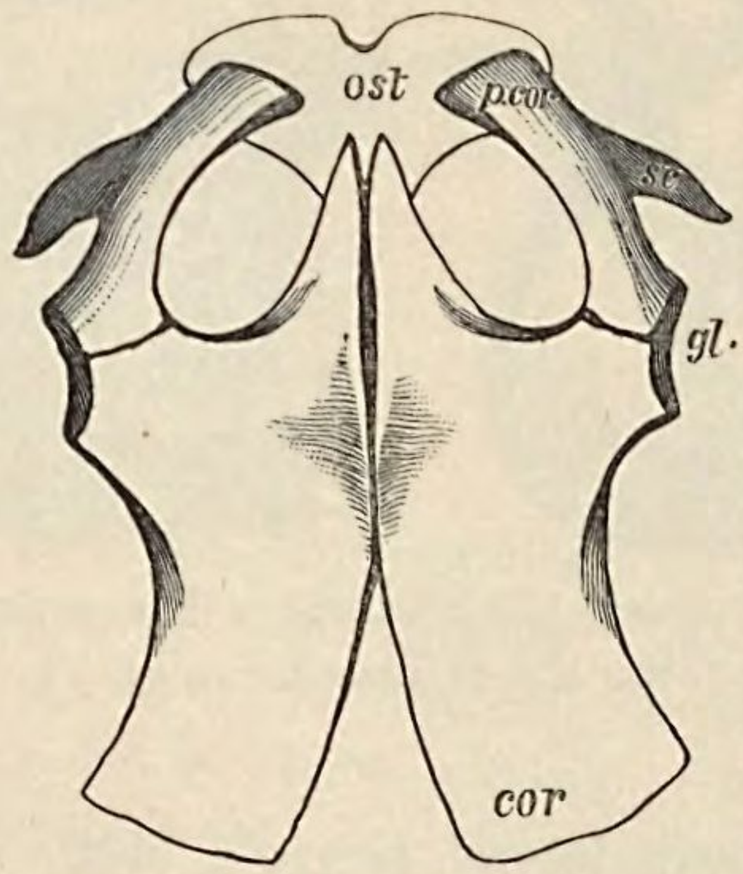
R. 1360. A series of twelve associated cervical vertebræ, in a somewhat crushed condition; from the Lower Lias of Charmouth, Dorsetshire. These specimens are placed in at the anterior extremity of the cervical region of the skeleton of *Plesiosaurus conybeari*, No. 40140 (p. 270), under which heading they are again noticed.

Purchased.

Genus **PLESIOSAURUS,** Conybeare[1].

Skull small or moderately large, with short or somewhat elongated rostrum and mandibular symphysis. Teeth generally slender, not carinated, and the anterior ones usually not enlarged to any marked extent. Neck more or less elongated, with the anterior vertebræ

Fig. 77.



Plesiosaurus hawkinsii.—Ventral aspect of the pectoral girdle; from the Lower Lias of Dorsetshire. About $\frac{1}{4}$. *ost*, omosternum; *sc*, scapula; *p.cor*, ventral (precoracoidal) plate of do.; *gl*, glenoid cavity; *cor*, coracoid. In reality the extremity of the omosternum is wedged in between the extremities of the coracoids.

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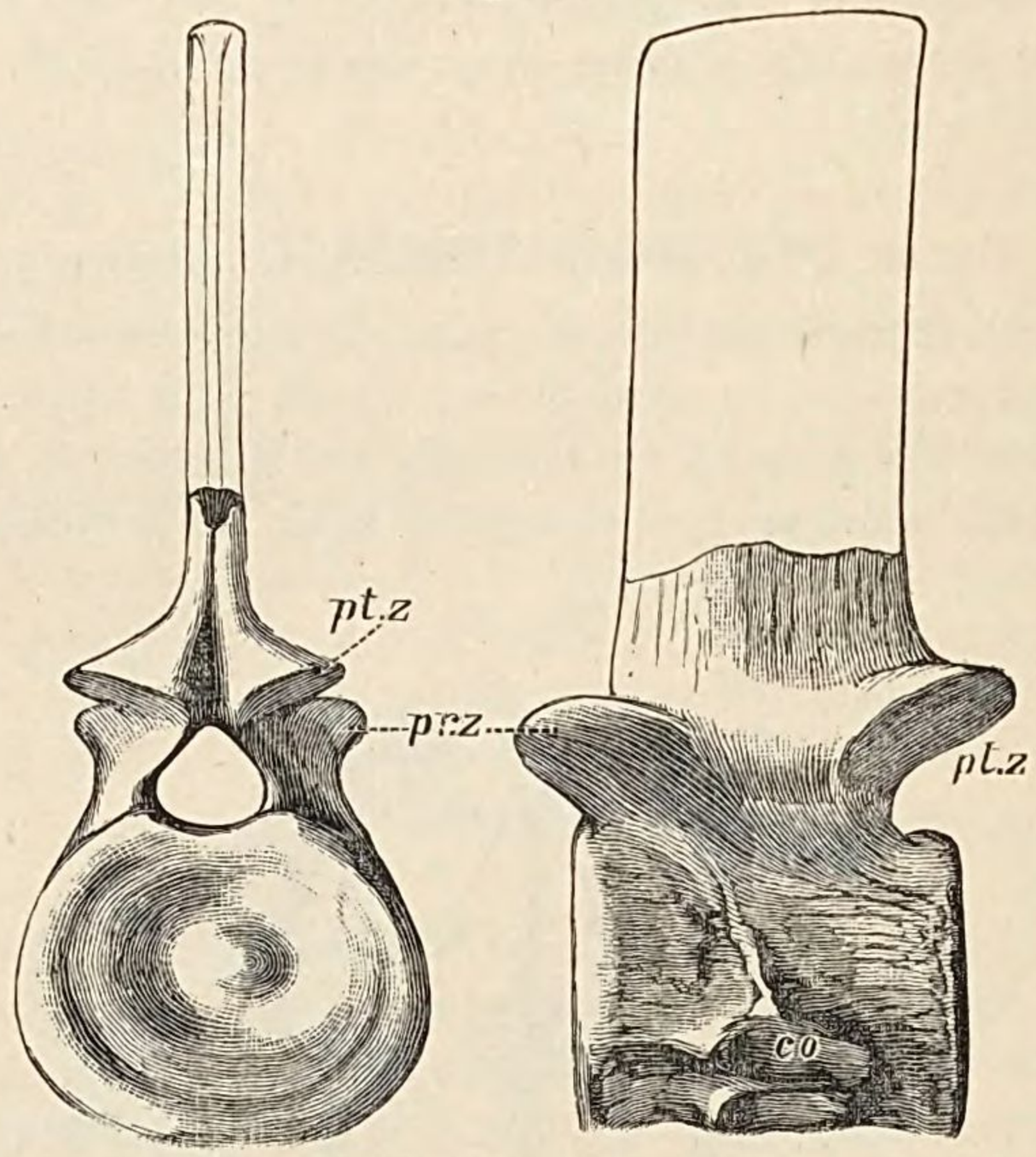
[1] Trans. Geol. Soc. ser. 1, vol. v. pt. 2, p. 560 (1821).

small or not very large. Vertebræ with the arches and cervical ribs firmly attached to the centrum, but with the suture not obliterated; zygapophyses slightly curved, and zygosphenes not strongly developed. Cervicals usually with moderately long centra, generally having double costal facets (fig. 78), and the terminal faces transversely ellipsoidal and more or less cupped. Dorsals without distinct forward overhang of centrum. Pectoral girdle (fig. 77) with the scapulæ small, and widely separated in the middle line, where they rest upon the omosternum; ventral plate of scapula narrow, and set at right angles to, and not larger than, the dorsal, which gives off a long projection; coracoids long and narrow, with a median anterior production; coracoidal foramen large and open anteriorly; omosternum of moderate size, consisting of two elements,

Fig. 78.



Plesiosaurus homalospondylus.—Left lateral and posterior aspects of a late cervical vertebra; from the Upper Lias of Curcy. $\frac{1}{3}$. Letters as in fig. 69, p. 225.

in shape like a subequilateral triangle, with a narrow and deep anterior notch. In pelvis ischia moderately elongated; pubes with distinct acetabular production. Humerus either rather shorter than or nearly equal in length with the femur, and articulating distally only with the radius and ulna (fig. 79), which are more or less elongated, and separated by a distinct interval; ulna and fibula reniform, the former more slender and sometimes longer than the latter.

A. *Macrospondyline Group.*

Skull (when known) small, with short mandibular symphysis. Cervical vertebræ (fig. 78) with the centra much elongated, with elliptical and more or less flattened terminal faces and double costal facets. Caudals elongated. Pectoral girdle unknown.

The close resemblance between the centra of the cervical vertebræ of this group and those of the typical group of *Cimoliosaurus* suggests the descent of the latter from the present group.

Plesiosaurus homalospondylus, Owen[1].

Of medium size. Skull very small, of nearly equal width throughout, the premaxillæ being very broad; neck very long, the length of the skull being contained $6\frac{1}{2}$ times in the interval between the atlas and the pectoral girdle. About 38 cervical vertebræ, in which the centra are very broad and flattened inferiorly, with the costal facets much elongated antero-posteriorly, while the neural spines are extremely tall and wide. Six bones in carpus and tarsus; radius and ulna elongated.

Hab. Europe (England and France).

36184. Slab showing the nearly entire skeleton; from the Upper (*Fig.*) Lias of Whitby, Yorkshire. The type specimen; described and figured by Owen in his 'Liassic Reptilia,' Sauropterygia, p. 12, pls. v.–vii. With the exception of part of the caudal region, the entire vertebral column is shown; in the cervical region from the dorsal, and posteriorly from the right lateral aspect. Of the limbs only the propodial bones are shown; and only a moiety of the right side of the pectoral girdle is exhibited. A radius and a tibia, as well as several of the more distal bones of the paddles are preserved separately. *Purchased*, 1861.

36184 a. Casts of the 13th and 14th cervical vertebræ of the preceding specimen. The dimensions of the larger centrum are:—length 0,049 (1·93 inches), height 0,034 (1·34 inches), width 0,048 (1·88 inches). The fourteenth is figured by Owen, *op. cit.* pl. v. figs. 2–4.

Made in the Museum.

R. 1334. Two later contiguous imperfect cervical vertebræ; from the Upper Lias of Whitby. The neural spines and ribs are wanting; and the double costal facets are very clearly

[1] Liassic Reptilia (Mon. Pal. Soc.)—Sauropterygia, p. 12 (1865).

shown. The dimensions of the larger centrum are :—length 0,064 (2·5 inches), height 0,042 (1·65 inches), width 0,057 (2·24 inches). *Presented by E. Charlesworth, Esq.*

40118. The imperfect centrum of a later cervical vertebra ; probably from Whitby. The double costal facets are very beautifully shown. The dimensions of the centrum are:— length 0,069 (2·7 inches), height 0,052 (2·05 inches), width 0,065 (2·75 inches). *Purchased.*

32717. (*Fig.*) Five imperfect associated late cervical vertebræ ; from the Upper Lias of Curcy (Calvados), France. The first of the series, which is figured with the spine restored in fig. 78, although slightly larger, agrees very closely with the preceding specimen ; the dimensions of the centrum being, length 0,069 (2·74 inches), height (posterior face) 0·056 (2·2 inches), width 0,074 (2·9 inches). The double costal facets are clearly shown.

Tesson Collection. Purchased, 1857.

R. 1366. Two middle caudal vertebræ united by matrix, and wanting the greater portion of the neural spines ; probably from Whitby. The length of the centrum of the hinder of the two is 0,047 (1·85 inches), and its width 0,054 (2·14 inches). These specimens accord closely with the middle caudals of the type, and are relatively much larger than those of any other species of the genus. The anterior one has chevron-facets on the posterior border only, the hinder on both borders. *No history.*

R. 1367. Two very similar specimens ; from Whitby. Each centrum has chevron-facets on both borders. *No history.*

Plesiosaurus, sp.

(*Cf. Plesiosaurus dewalquii*, Van Beneden [1].)

Imperfectly known. Smaller than the preceding ; cervical vertebræ relatively shorter, with the terminal faces of the centra more cupped, the hæmal surface less flattened, with a distinct carina, the costal facets less narrow, and the neural spines probably shorter. The cervical vertebræ from the Lower Lias of Luxemburg, described and figured by Van Beneden in the 'Mém. Ac. R. Belg.' vol. xliii. art. 12, p. 41, pl. iv. (1880), under the name of *P. dewalquii*,

[1] Bull. Ac. R. Belg. sér. 2, vol. xxi. p. 15 (1871).

although somewhat smaller, present a marked resemblance to the undermentioned specimens, which may perhaps belong to the same species.

Hab. Europe (England and [?] Luxemburg).

R. 1440. Three imperfect cervical vertebræ, cemented together by matrix; from the Lower Lias of Barrow-on-Soar, Leicestershire. The neural spines and portions of the arches are wanting, but there is a natural cast of the neural canal. The dimensions of the centrum of the hindmost specimen are:—length 0,035 (1·38 inches), height 0,032 (1·26 inches), width 0,037 (1·45 inches); the corresponding dimensions of one of the cervicals of *P. dewalquii* being 0,024 (0·96 inch), 0,021 (0·83 inch), 0,028 (1·1 inches). *Presented by Mrs. R. Etheridge*, 1888.

R. 1335. Three larger imperfect cervical vertebræ, cemented together by matrix; from the Lower Lias, locality unknown. The neural spines are wanting, and the hindermost centrum has been transversely cut and polished. *No history.*

B. *Typical Group.*

Skull either small or comparatively large, with short mandibular symphysis. Cervical vertebræ (fig. 80), with the centra of moderate length, having more or less distinctly cupped terminal faces and double costal facets; neural spines of moderate height or short.

The characters of the cervical vertebræ of this group are such that those of the Cœlospondyline group of *Cimoliosaurus* might well have been evolved from them.

Plesiosaurus dolichodirus, Conybeare [1].

Syn. *Plesiosaurus cliduchus*, Seeley [2].

The type species; of moderate size. Skull small, with a short V-shaped mandibular symphysis (fig. 47, C). Neck very long, the length of the skull being contained about six times in the interval between the atlas and the pectoral girdle. Vertebræ with rugosities at the extremities of the centra. Cervicals some 41 in number, with the centra relatively long, having the costal facets widely separated from the neuro-central suture, the terminal faces slightly cupped, and the hæmal foramina separated by a very slight ridge,

[1] Trans. Geol. Soc. ser. 2, vol. i. pt. ii. p. 389 (1824).
[2] Ann. Mag. Nat. Hist. ser. 3, vol. xvi. p. 356 (1865).

the neural spines being tall and squared at the summits. Dorsals with comparatively long and slightly cupped centra, with a tall and pyriform neural canal. Humerus and femur rugose at the extremities. Ulna and fibula relatively long and narrow. Carpus with 4 proximal and 3 distal bones.

P. cliduchus was separated mainly on the rugosity of the vertebræ, a character which is well marked in the type of the present species.

Hab. Europe (England).

22656. (*Fig.*) Slab showing the ventral aspect of a nearly entire skeleton, in a somewhat disjointed condition; from the Lower Lias of Lyme-Regis, Dorsetshire. The type specimen; discovered in 1823, and formerly in the collection of the Duke of Buckingham. Described and figured by Conybeare in the 'Trans. Geol. Soc.' ser. 2, vol. i. p. 381, pl. xlviii.; and noticed by Owen in his 'Liassic Reptilia,' Sauropterygia (Mon. Pal. Soc. 1865), p. 1. The skull is somewhat damaged. The vertebræ show distinct rugosities at the borders of the centra, and also the double costal facets. The pectoral girdle is wanting, but the pelvis is in good preservation. The left pectoral and the right pelvic limb are nearly entire. The postaxial bone of the proximal row of the carpus shown in Conybeare's figure is now wanting. *Purchased*, 1848.

R. 1313. (*Fig.*) Slab showing the nearly entire skeleton of a somewhat larger individual; from Lyme-Regis. Figured by Buckland in his 'Geology and Mineralogy' (Bridgewater Treatise), pl. xvi. fig. 2, and noticed by Owen, *loc. cit.* The skull is seen from the ventral aspect, and exhibits the entire mandible and the broken palatal region of the cranium. The anterior cervical vertebræ are thrown out of place, but the later ones are in apposition and seen from the left side. The dorsal and caudal regions are seen from the right side. The right paddles are nearly entire; in the pectoral limb the postaxial proximal carpal is visible, although it is omitted from Buckland's figure. Small portions of the pectoral and pelvic girdles are visible. The vertebræ are distinctly rugose, and they appear to agree precisely with those of the imperfect vertebral column figured by Seeley in the 'Ann. Mag. Nat. Hist.' ser. 3, vol. xvi. pl. xv., under the name of *P. cliduchus*.

No history.—In Museum before 1832.

36183. Slab exhibiting an imperfect skeleton; from Lyme-Regis.
(*Fig.*) Figured by Owen in his 'Liassic Reptilia,' Sauropterygia, pls. i., ii. The skull and entire series of cervical vertebræ are shown; the skull and anterior cervicals being exhibited from the left side, and the later cervicals from the right side. The ventral aspect of the body is exposed, and shows the imperfect pectoral and pelvic girdles, the proximal portion of the right pectoral limb, and fragments of one pelvic limb. In the pectoral limb the postaxial carpal of the proximal row is shown. 37 true cervical vertebræ are apparent. *Purchased*, 1861.

R. 1314. Slab showing the right lateral aspect of the anterior part of the dorsal region of the vertebral column and the right pectoral limb; from Lyme-Regis. The fourth bone in the proximal row of the carpus is present. Length of humerus 0,197 (7·8 inches), width of distal extremity of humerus 0,092 (3·6 inches), length of radius 0,084 (3·3 inches), width of radius in middle of shaft 0,031 (1·2 inches). *No history.*

39490. Slab showing the dorsal aspect of the skull, and the left
(*Fig.*) lateral aspect of the first eight cervical vertebræ; from Lyme-Regis. Figured by Owen, *op. cit.* pl. iii. fig. 1. The skull is crushed flat, but shows both the upper and lower teeth. The atlas and axis are anchylosed together, and there is also anchylosis between the arches and centra of the other cervicals. *Purchased*, 1865.

41101. Slab exhibiting the palatal aspect of a crushed cranium, apparently specifically identical with the preceding; from Lyme-Regis. With the exception of some germs and a single broken one, the teeth are absent. In this specimen the palatines are seen to be separated in the median line by the pterygoids, which articulate anteriorly with the vomers. The small infraorbital foramina are very clear. *Purchased*, 1868.

39491. The dentary portion of a mandible probably belonging to
(*Fig.*) this species; from Lyme-Regis. Figured by Owen, *op. cit.* pl. iii. fig. 2. The first tooth of the left side remains. This specimen is also figured, with restoration, in fig. 47, (p. 150). *Purchased*, 1865.

28332. Fragment of matrix showing the ventral aspect of the symphysial extremity of a similar mandible; from Lyme-Regis. Six teeth are shown on the right side. *Purchased*, 1853.

R. 255. Slab showing the palatal aspect of a similar mandible; probably from Lyme-Regis. *Egerton Coll. Purchased*, 1882.

R. 1316. (*Fig.*) An imperfect cervical vertebra from the hinder part of the neck; from the Lower Lias of Charmouth, Dorsetshire. Figured by Owen, *op. cit.* pl. iii. figs. 4–6. This specimen closely resembles the 27th cervical of No. 36183, and is indistinguishable from the later cervicals of No. R. 1315. The dimensions of the centrum are:—length 0,035 (1·36 inches), height 0,032 (1·25 inches), width 0,040 (1·66 inches). The heads of the ribs are attached to the centrum. *No history.*

37396. A crushed cervical vertebra of similar type; from Lyme-Regis. *Purchased*, 1863.

33287. (*Fig.*) An imperfect dorsal vertebra, referred by Owen to this species; from Charmouth. Figured by Owen, *op. cit.* pl. iv. figs. 1, 2. *Purchased*, 1858.

R. 1316 a. A series of cervical, dorsal, and caudal vertebræ associated with No. R. 1316. *No history.*

R. 1316 b. (*Fig.*) Two caudal vertebræ associated with the preceding. Figured by Owen, *op. cit.* pl. iv. figs. 3–8. *No history.*

2054*. An imperfect cervical vertebra in a somewhat crushed condition; from Lyme-Regis. *Hawkins Collection.*

23175. An imperfect immature late cervical vertebra, probably belonging either to this or the next species; from Lyme-Regis. The dimensions of the centrum are:—length 0,301 (1·2 inches), height 0,026 (1·02 inches), width 0,034 (1·35 inches). This specimen differs from the cervicals noticed as *P. hawkinsi* (p. 265) by its relatively longer centrum; its smoother surface as compared with the preceding specimens may indicate reference to *P. eleutheraxon.* *Purchased. About* 1849.

33286. A laterally crushed late cervical vertebra which may belong to this species; from Lyme-Regis. The relatively long antero-posterior diameter may not improbably be due to pressure. *Purchased*, 1858.

R. 983. An imperfect middle dorsal vertebra probably belonging to this species; from Lyme-Regis. The neural spine and the greater part of the right transverse process are wanting. The dimensions of the centrum are:—length 0,034

(1·35 inches), height 0,035 (1·38 inches), width 0,042 (1·66 inches). This specimen appears indistinguishable from some of the detached dorsals of the type skeleton, showing the same tall and pear-shaped neural canal.

Presented by J. E. Lee, Esq., 1885.

31876. An imperfect dorsal vertebra of the same general type, but with a relatively shorter centrum, and therefore from a different part of the series; from Lyme-Regis. The rugosity of the outer surface is distinctly shown.

Purchased.

R. 1330. (*Fig.*) Slab showing the impression of the right lateral aspect of part of the hinder region of the skeleton of a small Plesiosaur, provisionally referred to this species; from the Lower Lias of Elston, near Newark, Nottinghamshire. A plaster cast has been taken from the impression to show the contour of the bones. This specimen is described and figured by W. Stukeley in the 'Phil. Trans.' for 1719, pp. 936–8, pl. i., by whom it was suggested that it might be either Crocodilian or Cetacean. It shows the hinder part of the dorsal and the anterior part of the caudal region of the vertebral column, together with portions of the pectoral limb. The long and slender contour of the fibula suggests reference to the present species rather than to *P. hawkinsi*.

(?) *Presented by the Council of the Royal Society.*

Plesiosaurus eleutheraxon, Seeley [1].

Imperfectly known. Distinguished from the preceding by the smooth vertebræ and limb-bones, the separation of the short atlas and axis, and the presence of eight carpal bones.

This species was founded upon an imperfect skeleton, in which the skull is wanting, from the Lower Lias, preserved in the Woodwardian Museum at Cambridge, and figured in pl. xiv. of the volume cited.

Hab. Europe (England).

41102. Slab exhibiting a pelvic (?) limb; from the Lower Lias of Lyme-Regis, Dorsetshire. There are eight tarsal bones, and the dimensions of the femur are:—length 0,215 (8·5 inches), width at the distal extremity 0,101 (4·0 inches),

[1] Ann. Mag. Nat. Hist. ser. 3, vol. xvi. p. 353 (1865).

these dimensions agreeing very closely with those of the femur of the type. There is, however, the normal number of phalangeals in the fifth digit, indicating that the distal ones have been lost in the type.

Purchased, 1868.

R. 227. An anterior cervical vertebra probably belonging to this species; from Lyme-Regis. In the relatively long centrum this specimen agrees with *P. dolichodirus*, but the outer surface is smooth.

Presented by Dr. H. Woodward, 1882.

39851. Three associated imperfect dorsal vertebræ which may, perhaps, belong to this species; from Lyme-Regis. The centra are relatively longer than in the dorsals resembling those of *P. hawkinsi* mentioned on p. 265; their dimensions being:—length 0,032 (1·25 inches), height 0,035 (1·48 inches), width 0·042 (1·65 inches); and the external surface is quite smooth. In a detached dorsal in the skeleton No. 2022* of *P. hawkinsi*, while the dimensions of the terminal faces of the centrum are almost identical with those of the present specimen, the length is only 0,024 (0·95 inch).

Purchased, 1865.

Plesiosaurus hawkinsi, Owen [1].

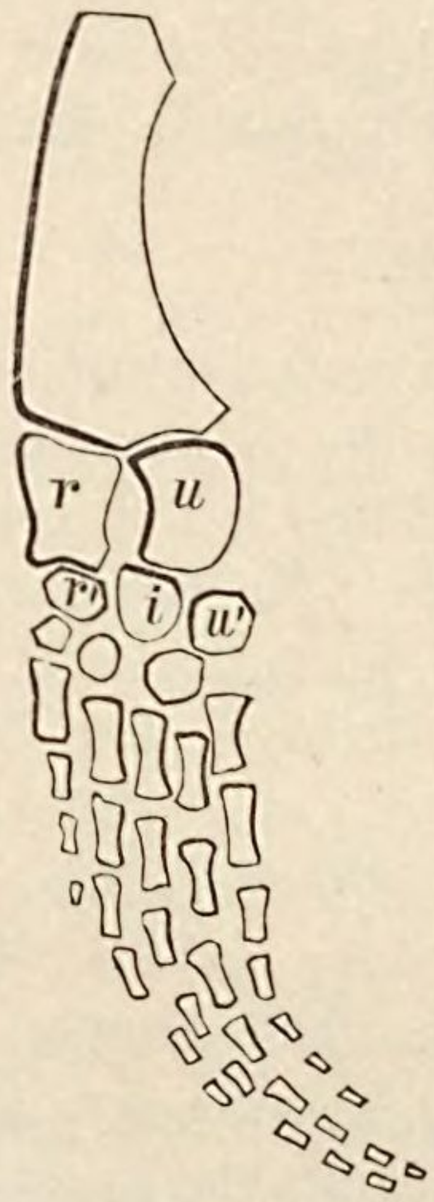
Syn. *Plesiosaurus triotarsostinus*, Hawkins [2].
Including *Plesiosaurus etheridgei*, Huxley [3].

Nearly of the size of *P. dolichodirus*, but with a much shorter neck, the length of the skull being contained about $3\frac{1}{2}$ times in the interval between the atlas and the pectoral girdle. Cervical vertebræ 30 or 31 in number, of the general contour of those of the type species, but externally smooth, with relatively shorter centra and neural spines, and in immature individuals with the upper costal facet approximated to the neuro-central suture. Dorsals with shorter and more distinctly cupped centra, and a lower and more rounded neural canal, the height of the arch and spine being less than twice the height of the centrum. In the pectoral girdle the anterior projection of the coracoid relatively long and extending far over the omosternum; and the omosternal extremity of the ventral plate of the scapula wider than the glenoidal. Limb-bones smooth; ulna

[1] Rep. Brit. Assoc. for 1839, p. 57 (1840).
[2] Memoirs on Ichthyosauri and Plesiosauri, pl. xxiv. (1834).
[3] Quart. Journ. Geol. Soc. vol. xiv. p. 281 (1858).

and fibula relatively shorter and wider than in the type species ; 6 bones in carpus (fig. 79) and tarsus. The author follows Owen and Huxley in regarding No. 2022* as the adult of the present species. That skeleton differs from the type in that the skull is shorter in proportion to the limb-bones and vertebral column, in the relatively larger carpals and tarsals, and the longer interval between the costal facets and the neuro-central suture of the cervical vertebræ. In regard to the first point it is well known that in Crocodiles the

Fig. 79.



Plesiosaurus hawkinsi.—Ventral aspect of the right pectoral limb ; from the Lower Lias of Street. $\frac{1}{7}$. *r*, radius ; *u*, ulna ; *r'*, radiale ; *i*, intermedium ; *u'*, ulnare.

length of the skull becomes relatively less in the adult [1] ; the second point is evidently due to immaturity ; while the value of the third difference may be inferred from the case of *P. macrocephalus* (p. 266). The specific name *triotarsostinus*, although the

[1] Theobald, 'Catalogue of Reptilia of India,' p. 36, states that the length of the skull and body in two individuals of *Crocodilus palustris* are as follows: —length of head 26 inches, length of body 18 feet ; and length of head 24·6 inches, and of body 12 feet. In the former instance the proportion of the head to the body being $\frac{1}{8}$, and in the latter $\frac{1}{6}$. This indicates the slight value which can be attached to the so-called "cephalic index" of Sollas (Quart. Journ. Geol. Soc. vol. xxxvii. p. 468) as a means of distinguishing the species of *Plesiosauridæ*.

earliest, has been rejected on account of its uncouthness[1]. The name *P. etheridgei* was applied to a small skeleton differing from the type in having 30, in place of 31, cervical vertebræ, and in some other slight details; since, however, an instance has been published of a variation in the number of presacral vertebræ among the Crocodilia[2], it appears highly probable that a similar variation would occur still more frequently in the present order, where there is great specific variation in the number of the cervical vertebræ. The specimen, No 48001, mentioned on p. 238, indicates, moreover, either the incipient division of a single cervical centrum into two, or the imperfect coalescence of two distinct centra.

While *P. dolichodirus* appears to have been the commoner form at Lyme-Regis, the present species seems to be more abundant at Street.

Hab. Europe (England).

2018*. (*Fig.*) Slab showing the ventral aspect of a nearly entire immature skeleton; from the Lower Lias of Street, near Glastonbury, Somersetshire. The type specimen. Figured by Hawkins in his 'Memoirs on Ichthyosauri, &c.' and 'Sea Dragons,' pl. xxiv., as *P. triotarsostinus*; by Buckland in his 'Geology and Mineralogy' (Bridgewater Treatise), pl. xvii., as *P. dolichodirus*; and by Haughton in his 'Manual of Geology,' fig. 40, under the latter name. Noticed by Huxley in the 'Quart. Journ. Geol. Soc.' vol. xiv. p. 284. The distal portion of the left pectoral limb is wanting, and the tarsus of both sides is imperfect. In the pectoral girdle the omosternum is damaged, and the caudal part of the vertebral column has been displaced.

Hawkins Collection. Purchased, 1834.

2019*. Cast of the preceding specimen, with the left pectoral limb restored. *Hawkins Collection.*

2020* (14551). (*Fig.*) Slab showing the ventral aspect of the nearly entire skeleton of an immature individual; from Street. Figured by Hawkins, *op. cit.* pl. xxvii., and noticed by Huxley, *op. cit.* p. 284 (as No. 14541). The distal portion of the left pectoral limb is wanting, and both the pectoral and pelvic girdles are imperfect. The displacement of the cervical ribs exhibits very clearly the double costal facets. The upper costal facets throughout the series

[1] In the 'Rep. Brit. Assoc.' for 1839, Owen proposed to reject this name as being incorrect.

[2] Baur, Zool. Anz. vol. ix. p. 689 (1886), records 25 in place of the normal 24 presacral vertebræ in *Garialis gangeticus*.

are closely approximated to the neuro-central suture. This specimen indicates a slightly larger individual than the preceding. The right limbs and three cervical vertebræ are also figured by Owen in the 'Trans. Geol. Soc.' ser. 2, vol. v. pls. xliii. and xliv. fig. 4; the right pectoral limb (fig. 79) being again figured by the same writer in his 'Liassic Reptilia,' Sauropterygia, pl. xvi. fig. 2.

Hawkins Collection.

2021*. (*Fig.*) Slab exhibiting the left lateral aspect of an imperfect skeleton; from the Lower Lias of Walton, Somersetshire. Figured by Hawkins, *op. cit.* pl. xxv., without specific name, and noticed by Huxley, *op. cit.* pp. 284, 285 (as No. 2000), and provisionally referred to *P. etheridgei.* The hinder part of the cervical and the whole of the dorsal region of the vertebral column are well preserved and in apposition; but the caudal region, of which the extremity is wanting, is dislocated. The two scapulæ are perfect, and exhibit very clearly the dorsal portion (see Hulke, 'Proc. Geol. Soc.' for 1883, p. 56, fig. 15). One humerus and one femur remain, as well as portions of the pelvic girdle.

Hawkins Collection.

R. 1331. Slab showing an imperfect limb apparently referable to this species; from Street. *Hawkins Collection.*

2022* (14549). (*Fig.*) Slab exhibiting the right lateral aspect of the somewhat imperfect and dislocated skeleton of an adult individual; from Street. Figured by Hawkins, *op. cit.* pl. xxviii. (without name), and the skull by Owen in the 'Trans. Geol. Soc.' ser 2, vol. v. pl. xlv.; noticed by Huxley, *op. cit.* pp. 284, 285. The sixth vertebra from the skull has lost its anterior half, and Huxley suggests that a vertebra may be missing here; there is a gap in the dorsal series, one of the vertebræ being separated from its position, and one of its terminal faces exposed. The pectoral and pelvic girdles are dislocated. In the cervical vertebræ the costal facets are separated by a considerable interval from the neuro-central suture. The skull is of the same length as the humerus, instead of being longer as in the type. *Hawkins Collection.*

14550. Slab showing the palatal aspect of the imperfect cranium and the left side of the greater portion of the remainder of an apparently similar skeleton; from Street. Noticed by Huxley, *loc. cit.* The skull has been displaced and is

situated near the commencement of the tail. The greater part of the vertebral column is well shown, but some of the anterior cervicals are absent, the dorsal region is dislocated, the hinder part of the column overlapping the anterior, and the greater portion of the caudal region lost. The dorsal part of the left scapula is well shown. The femur is preserved on either side, together with other parts of the pelvic limbs. In size this specimen accords closely with No. 2022*, and has the same relative proportions between the tibia and femur. The skull is noticed by Sollas in the 'Quart. Journ. Geol. Soc.' vol. xxxvii. p. 479. *Hawkins Collection.*

R. 45. A split slab of rock showing part of the skeleton of a small Plesiosaur not improbably belonging to this species; from the Lower Lias of Bennington, Leicestershire. Referred to in Nichols's 'History of Leicestershire,' vol. i. p. ccv. This specimen shows the middle portion of the dorsal region; fragments of the pectoral, and the greater portion of the pelvic girdle; the humerus of both sides; and the right femur. Although no decisive parts of the skeleton remain, the resemblance of the humerus and femur to the corresponding bones of the type is so close that there is a great probability of the specific identity of the two specimens. *Presented by Major Harlowe Turner*, 1880.

Plesiosaurus, sp.

The undermentioned specimen differs from *P. hawkinsi* in its rather larger dimensions, and the relatively taller spines of the dorsal vertebræ, which exceed double the height of the centra.

Hab. Europe (England).

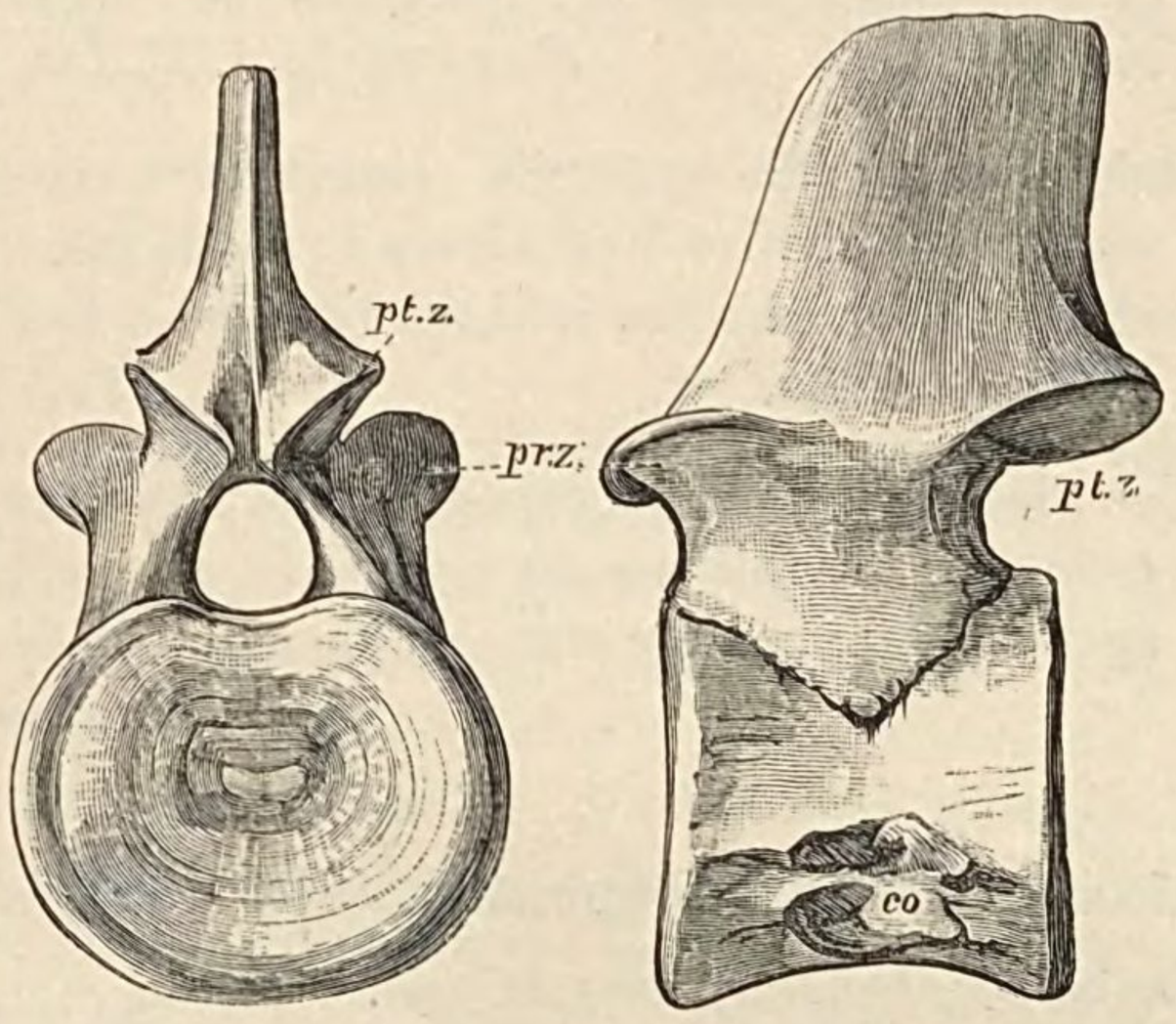
R. 1329. Slab showing part of a dislocated skeleton; from the Lower Lias of Street, near Glastonbury, Somersetshire. Parts of the cervical and dorsal regions of the vertebral column are shown, together with one humerus and the ulna of either side. The humerus agrees in size with that of the skeleton No. 2022* of *P. hawkinsi*, and the ulna is of the short and broad type characteristic of that species. The vertebræ are, however, larger than in that skeleton, and the dorsals have relatively taller neural spines, although exhibiting the same short centra, with distinctly cupped terminal faces and a broad and low neural canal.

Hawkins Collection. Purchased, 1834.

Most of the following specimens probably belong either to P. hawkinsi *or to the above-mentioned unnamed form.*

2055*. Two imperfect late immature cervical vertebræ; from the Lower Lias of (?) Lyme-Regis, Dorsetshire. In the specimen figured in the accompanying woodcut the dimensions of the centrum are:—length 0,029 (1·16 inches), height 0,028 (1·1 inches), width 0,037 (1·45 inches). In size these specimens accord with the later cervicals of No. 2020*, (*Fig.*)

Fig. 80.



Plesiosaurus (*cf.*) *hawkinsi*.—Anterior and left lateral aspects of a later cervical vertebra; from the Lower Lias of Lyme-Regis. ⅔. Letters as in fig. 69, p. 225.

but the costal facets are placed lower down on the centrum, in which respect they resemble Nos. 2021* and 14550. The arches and ribs are not anchylosed to the centra. *Hawkins Collection. Purchased*, 1834.

2055* a. A similar, but rather smaller imperfect cervical vertebra; from Lyme-Regis. The neuro-central suture is distinct and the ribs are wanting. *Hawkins Collection.*

R. 227 a. Two imperfect anterior cervical vertebræ, apparently resembling those of the skeleton No. 2022*; from Lyme-Regis. The neuro-central suture is obliterated, and the ribs are firmly anchylosed to the centrum.

Presented by Dr. H. Woodward, 1882.

2060*. An imperfect dorsal vertebra ; from Street. In its ventral aspect this specimen closely resembles the dorsals of the skeleton No. 2020*. The dimensions of the centrum are : —length 0,025 (0·96 inch), height 0,033 (1·3 inches), width 0,039 (1·54 inches). The distinctly cupped centrum and low and broad neural canal are well seen.

Hawkins Collection.

R. 654. An entire late dorsal vertebra of similar general type ; from Lyme-Regis. In general characters this specimen agrees very closely with the detached dorsal in No. 2022*, but the neural spine is taller, exceeding twice the height of the centrum, and thus resembles the unnamed skeleton No. R. 1329. *Presented by J. E. Lee, Esq.*, 1885.

43061. Slab showing the posterior aspect of a crushed dorsal vertebra of similar type ; from Lyme-Regis. The height of the arch and spine is about two and a half times that of the centrum. *Purchased*, 1871.

2039*. Slab showing the ventral aspect of a mandible not improbably belonging to this species ; from Street. This specimen agrees approximately with the mandible of No. 2022*.

Hawkins Collection.

Plesiosaurus macrocephalus, Owen [1] (*ex* Conybeare).

Syn. *Plesiosaurus brachycephalus*, Owen [2].

Of comparatively large size, the length of the skeleton of the type of *P. brachycephalus* being 10 feet 6 inches. Skull relatively large, wide posteriorly, but with the premaxillary region much narrowed, its length being contained about two and a half times in the interval between the atlas and the pectoral girdle. Neck short, with some 30 vertebræ [3] ; cervicals short, with the upper costal facet in immature specimens confluent with the facet for the arch ; terminal faces slightly cupped, and hæmal aspect with very slight ridge ;

[1] Rep. Brit. Assoc. for 1839, p. 62 (1840), and Trans. Geol. Soc. ser. 2, vol. v. pt. 3, p. 515 (1840, read 1838).

[2] Rep. Brit. Assoc. for 1839, p. 69 (1840).

[3] Owen gives the number of cervicals in *P. macrocephalus* as 29, and states that at least 28 are cervical in *P. brachycephalus*. Sollas (Quart. Journ. Geol. Soc. vol. xxxvii. p. 479) states that in the latter the 29th is certainly cervical, and that the 30th and 31st are probably also referable to the neck. In the type of the former there is no reason why there should not be a similar number of cervicals, since the sides of the 30th and 31st vertebræ are not exposed.

neural spines comparatively short, with squared summits. Pectoral girdle not exposed. Humerus much shorter than femur. Radius and ulna and tibia and fibula relatively very short; 8 bones in carpus and tarsus.

P. brachycephalus was distinguished solely on account of the lower position of the costal facets of the later cervical vertebræ—a character which may apparently well be due to maturity, the type being in all other respects identical with the immature type of the present species.

Hab. Europe (England).

R. 1336. (*Fig.*) Slab exhibiting the dorsal aspect of the skull and paddles and the right lateral aspect of the vertebral column of a half-grown individual; from the Lower Lias of Lyme-Regis, Dorsetshire. The type specimen. Described by Owen in the 'Rep. Brit. Assoc.' for 1839, p. 62, and described and figured by the same writer in the 'Trans. Geol. Soc.' ser. 2, vol. v. pp. 515–535, pls. xliii.–xlv. Also figured by Buckland in his 'Geology and Mineralogy' (Bridgewater Treatise), pl. xix. fig. 1, and by Haughton in his 'Manual of Geology,' fig. 39, facing p. 274. The head and neck are twisted round to the left; the greater part of the caudal region and the right pelvic limb are wanting. In the cervical region the ribs are displaced, permitting the junction of the costal with the neurapophysial facets to be beautifully shown. The eight carpal bones are shown in both limbs, but only six tarsals remain in the pelvic limb. With the exception of the left scapula, only the borders of the pectoral and pelvic girdles are visible. The length of the cranium is about 0,215 (8·5 inches), and that of the mandible 0,269 (10·5 inches). The humerus has a length of 0,101 (4·0 inches), and the femur of 0,120 (4·7 inches). The resemblance of this specimen to the larger type skeleton of *P. brachycephalus* figured by Sollas in the 'Quart. Journ. Geol. Soc.' vol. xxxvii. pl. xxiv. fig. 2, is so close as to render it almost certain that the one is the immature condition of the other. The adult skeleton indicates an individual somewhat less than twice the size of the present specimen, the length of the skull being 0,354 (14 inches), that of the humerus 0,227 (9·0 inches), and that of the femur 0,247 (9·7 inches).

Purchased from the Earl of Enniskillen.

28307. Slab exhibiting the right lateral aspect of the posterior cervical and anterior dorsal region of the vertebral column and the two humeri of a nearly similar immature individual; from Lyme-Regis. Thirty vertebræ remain, some five of which are cervical, the latter showing the characteristic junction of the costal with the neurapophysial facets. As in the posterior cervicals of the type, the two costal facets have coalesced. The humerus is slightly larger than that of the type. *Purchased*, 1853.

49202. The skull and anterior cervical vertebræ of an adult individual; from Lyme-Regis. The frontal region has been crushed, thus causing the vertical diameter of the orbit to be much shortened; but in other respects the specimen is fairly perfect. The anterior cervical vertebræ show the characteristic union of the upper costal with the neurapophysial facet, although the arches have become anchylosed; they have a small hæmal carina. The characters of the skull accord closely with those of the smaller crushed skull of the type; and the specimen is indistinguishable from the skull of *P. brachycephalus* figured by Sollas, both specimens showing the contracted premaxillæ, expanding into a spoon-shaped termination, and traversed by a distinct median ridge. The length from the extremity of the premaxillæ to the occipital crest is 0,291 (11·5 inches). *Purchased*, 1878.

31887. The centrum of an anterior cervical vertebra of a larger individual; from Lyme-Regis. The union of the upper costal facet with that for the neurapophysis is very clearly shown. *Purchased from the Earl of Enniskillen.*

31883–84, –85, –86, –88, –90 to –98. A number of centra of "pectoral," lumbar, and caudal vertebræ associated with the preceding. *Purchased from the Earl of Enniskillen.*

33285. Slab showing three later cervical vertebræ, referred by Owen (and apparently rightly) to the present species; from Lyme-Regis. These specimens indicate an adult individual, the dimensions of one of the centra being:—length 0,028 (1·1 inches), height 0,038 (1·5 inches), width 0,046 (2·0 inches). The centra closely resemble those of No. 28307, but the upper costal facet is less completely connected with the facet for the arch. *Purchased*, 1858.

Plesiosaurus conybeari, Sollas [1].

Syn. *Plesiosaurus laticeps*, Owen, MS. [2]
? *Plesiosaurus latispinus*, Van Beneden [3] (*non* Owen).

The largest species. Skull (if rightly referred) of moderate size, its length being contained about three and a half times in the interval between the atlas and the pectoral girdle. Neck long, with 38 vertebræ. Cervical vertebræ of moderate length, with nearly flat terminal faces to the centra, and the hæmal surface with a low and blunt ridge between small foramina; neural spines comparatively tall, with squared summits. Anterior prolongation of coracoids short, and consequently a large part of the omosternum exposed; omosternal end of ventral plate of scapula narrower than coracoidal. Radius and ulna relatively long and narrow; 6 bones in carpus and tarsus. The length of the entire skeleton was probably about 16 feet.

The dorsal vertebræ from the Lower Lias of Luxemburg, described by Van Beneden and identified by him with the Cretaceous *Cimoliosaurus* (*Plesiosaurus*) *latispinus*, may, from their large size, be referable to the present species.

Hab. Europe (England and [?] Luxemburg).

R. 1338. Cast of a laterally compressed skull, apparently belonging to the type specimen. The original was obtained from the Lower Lias of Charmouth, Dorsetshire, and is preserved in the Museum at Bristol. It is figured by Sollas in the 'Quart. Journ. Geol. Soc.' vol. xxxvii. pl. xxiii. fig. 1, in conjunction with the type skeleton, and separately in pl. xxiv. fig. 1. The evidence does not appear to be absolutely decisive that this skull was found with the skeleton, although such was probably the case. In length and the proportions of the different parts the cranium closely accords with that of *P. rostratus*, but the symphysis of the mandible is much shorter, having a length of only three inches. *Purchased.*

39514. (*Fig.*) A crushed and imperfect skull, apparently resembling the preceding specimen; probably from the Lower Lias of Lyme-Regis. Described and figured by Owen in his 'Liassic Reptilia' (Mon. Pal. Soc.), Sauropterygia, p. 28, pl. xiii., and provisionally referred to *P. rostratus*. In

[1] Quart. Journ. Geol. Soc. vol. xxxvii. p. 440 (1881).
[2] Davies, Geol. Mag. dec. 1, vol. iv. p. 144 (1867).—Undefined.
[3] Mém. Ac. R. Belg. vol. xliii. art. 12, p. 33, pls. i.–iii. (1882).

the shortness of the mandibular symphysis this specimen differs from the mandible of the type skeleton of the latter, and agrees with the preceding specimen. Owen states that the locality is Charmouth. *No history.*

R. 1370. Part of the parieto-frontal region of a skull, apparently agreeing with the corresponding portion of No. R. 1338; from the Lower Lias, locality unknown. The ridge dividing the supra-temporal fossæ is nearly entire, while the parietal foramen is quite perfect. *No history.*

R. 1339. Two casts of the opposite sides of a slab showing the greater portion of the skeleton, without the head. The original specimen is the type, and was obtained from Charmouth; it is preserved in the Museum at Bristol, and is figured by Sollas, *op. cit.* pl. xxiii. Nearly the whole of the vertebral column is shown, together with the greater portion of the pectoral and pelvic girdles, and the entire pectoral limbs. Of the pelvic limbs only the femora are shown. *No history.*

40140. Slab showing the two sides of an imperfect skeleton; from Charmouth. As exhibited in the case the slab shows the oblique right lateral and ventral aspects, the left side of the vertebral column being shown by a cast. There remain 13 cervical vertebræ in advance of the omosternum, but to the extremity of this series there are appended 12 cervicals of another species, which are noticed under the head of *Eretmosaurus* (p. 251). An imperfect cranium is attached to the specimen, which may really belong to it. The whole of the remaining portion of the vertebral column is shown, together with the pectoral and pelvic girdles, and the left humerus and femur. The specimen is noticed by Sollas, *op. cit.* pp. 470, 471, who remarks its close resemblance to the type, and also that there is probably some malarrangement in the cervical region, although it was not suggested that the earlier vertebræ were specifically distinct. The anterior extremities of the coracoids are wanting, but it is evident that, as in the type, these bones did not overlap the omosternum to such an extent as in *P. hawkinsi*. This skeleton is noticed by Davies in the 'Geol. Mag.' dec. 1, vol. i. p. 144, as the type of *P. laticeps*. *Purchased.*

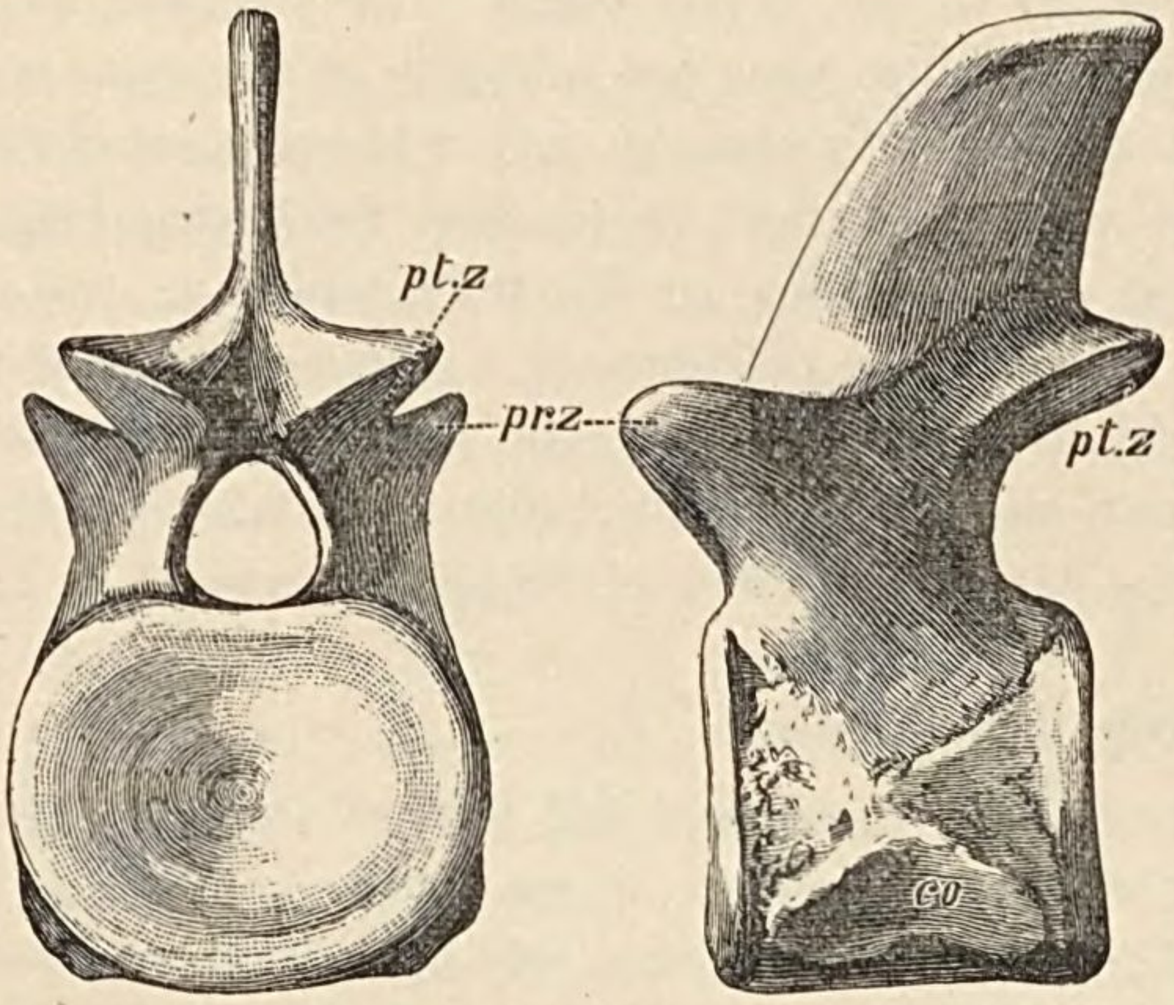
2056*. An imperfect late cervical vertebra, apparently referable to this species; probably from Lyme-Regis.

Hawkins Collection. Purchased, 1834.

C. *Longirostrine Group.*

Skull comparatively large, with long mandibular symphysis. Cervical vertebræ of moderate length, with the terminal faces of

Fig. 81.



Plesiosaurus rostratus.—Left lateral and posterior aspects of a middle cervical vertebra; from the Lower Lias of Lyme-Regis. ½. Letters as in fig. 69, p. 225.

the centra deeply cupped, the costal facets either single or double, and the neural spines very short. Pectoral girdle unknown.

This group is represented in the Upper Lias by *P. longirostris*, Blake [1], which is probably identical with *P. cœlospondylus*, Owen [2]. It is not improbable that *Peloneustes* may be directly descended from this group.

Plesiosaurus rostratus, Owen [3].

Of comparatively large size, the length exceeding 12 feet. Skull with the premaxillary region produced into a spatulate rostrum. Neck probably of considerable length, the number of vertebræ being unknown. Cervical vertebræ with the cupped terminal faces of the centra bevelled at the edges, and the hæmal surface with a prominent ridge flanked on either side by a deep pit; in the anterior region the apparently single costal facet placed low down

[1] In Tate and Blake's 'Yorkshire Lias,' p. 250 (1876).

[2] Liassic Reptilia (Mon. Pal. Soc.), Sauropterygia, p. 12 (1865).—Insufficiently characterized.

[3] *Ibid.* p. 20 (1865).

on the centrum ; neural spines with anterior border curving backwards to form a pointed summit, and the height from above the postzygapophysis less than that of the latter above the centrum. Posterior cervicals and anterior dorsals with very short centra, in which the terminal faces are extremely elliptical. Humerus and femur nearly equal in length. Radius and ulna comparatively long and narrow ; 6 carpal and tarsal bones.

The number of cervical vertebræ is given by Owen as 24, but since there are 33 in the closely allied *P. longirostris*, this is *primâ facie* improbable. That some are missing in the type is shown by plate xi. fig. 2 of Owen's memoir, where there must obviously have been a gap between the narrow centra described as the 16th and 17th, and the broad one regarded as the 18th, which is evidently much later in the series. The existence of a larger number of vertebræ is also shown by No. R. 1337. In the figures of the 15th vertebra given by Owen on pl. x. it appears that the contour of the terminal faces has been drawn from one of the later cervical or early dorsal vertebræ.

Hab. Europe (England).

38525. (*Fig.*) Slab showing the dorsal and part of the right lateral aspect of the nearly entire skeleton ; from the Lower Lias of Charmouth, Dorsetshire. Described and figured by Owen in his ' Liassic Reptilia,' Sauropterygia, p. 20, pls. ix.–xii. The cranium is much crushed, and is dislocated from the neck ; the mandible, which is laterally flattened, and can be removed from the matrix, exhibits the teeth in very perfect preservation. There are several dislocations in the cervical region, and, as already mentioned, some vertebræ are missing after the 17th ; reference has also been made to the incorrect contour of the terminal faces of the middle cervicals in Owen's memoir. The terminal face of an early dorsal is exposed. The whole of the limbs are complete, but only the borders of the pectoral and pelvic girdles are visible. *Purchased*, 1863.

R. 37. The broken muzzle of a skull much obscured by matrix, probably referable to the present species ; from the Lower Lias of Lyme-Regis, Dorsetshire. Many of the teeth are well shown. *Purchased*, 1880.

R. 1337. Slab showing the left lateral aspect of an imperfect skeleton ; from the Lower Lias, probably of Lyme-Regis. This specimen, which has evidently been much waterworn, exhibits a part of the skull in a greatly damaged condition,

a large part of the cervical and dorsal regions of the vertebral column, one entire and one broken propodial bone, and some other fragments of the limbs. In the skull the size of the supratemporal fossa accords precisely with that of the type; but no other comparisons can be made. The division between the cervical and dorsal regions of the vertebral column cannot be determined; but apparently at least 30 cervicals may be counted. These cervicals have comparatively short centra, in which the terminal faces are deeply cupped at the centre, with bevelled edges, the hæmal surface having a prominent ridge flanked by a deep pit on either side; the costal facets are very low down on the centrum and may be undivided; and the neural spines are very short and broad, with the characteristic terminal contour. The dimensions of the centrum of the 11th vertebra remaining in the series are:—length 0,034 (1·35 inches), height 0,040 (1·56 inches), width 0,046 (1·8 inches). In all these respects these vertebræ agree with those of the type, and since they are quite different from the corresponding vertebræ of *P. macrocephalus* and *P. conybeari*, there can be little doubt that the specimen belongs to the present species. The early dorsals have the transversely expanded terminal faces of the exposed dorsal of the type, but their absolute size has been reduced by the exposure to which the specimen has been subjected. The vertebræ accord very closely with the description of those of *P. longirostris* (*cœlospondylus*). *No history.*

39849. (*Fig.*) A slightly imperfect middle cervical vertebra; from Lyme-Regis. This specimen (woodcut, fig. 81) closely resembles the 12th or 13th of those in apposition in the preceding specimen; and is quite indistinguishable from the 15th of the type skeleton, of which a correct lateral view is given by Owen, *op. cit.* pl. x. fig. 1. The peculiar contour and extreme shortness of the neural spine is well shown, and the costal facets appear to be single. On the hæmal aspect the pits flanking the median ridge are very distinct. The dimensions of the centrum are:—length 0,043 (1·69 inches), height 0,044 (1·72 inches), width 0,050 (1·96 inches), the total height of the specimen being 0,104 (4·1 inches). *Purchased*, 1866.

28318. An associated series of sixteen somewhat imperfect ver-

tebræ; from the Lower Lias of Lyme-Regis. These specimens comprise one late cervical, four "pectorals," and seven dorsals. The late cervical and the pectorals agree closely with the corresponding vertebræ of the type skeleton figured by Owen, *op. cit.* pl. xii.; the summit of the neural spine in the cervical is unfortunately broken off, but sufficient remains to show the characteristically short and pointed contour. The costal facets show traces of a division, and have become vertically elongated, in place of the longitudinal elongation shown in No. 39849. The dimensions of the centrum of the cervical are:—length 0,044 (1·74 inches), height 0,052 (2·05 inches), width 0·063 (2·48 inches).

Purchased, 1853.

Of the following teeth it is probable that some belong to the present or the next species, while others may be referable to P. conybeari.

41284. A crushed tooth, in matrix; from Lyme-Regis.

Purchased, 1869.

42015. A very similar tooth; from Lyme-Regis. *Purchased*, 1870.

43059. A smaller tooth, in matrix; from Lyme-Regis.

Purchased, 1871.

32747. A large tooth; from Lyme-Regis. *Purchased*, 1857.

R. 1371. A tooth of similar type, in matrix; from Lyme-Regis.

No history.

Plesiosaurus, sp.

Apparently allied to *P. rostratus*, but of somewhat larger dimensions. Cervical vertebræ with the ridge on the hæmal surface more prominent, the costal facets distinctly double, and in the anterior part of the region the pits on either side of the hæmal ridge not distinctly developed. Terminal faces of the dorsal centra heart-shaped.

Hab. Europe (England).

R. 1328. The centrum of a posterior cervical vertebra; from the Lower Lias, locality unknown. The dimensions of this specimen are:—length 0,051 (2·0 inches), height 0,054 (2·13 inches), width 0,068 (2·66 inches). It agrees in general characters with the 30th or 31st vertebra of the

skeleton No. R. 1337 of *P. rostratus*, but is of larger size; in which respect it agrees with the dorsals of the next specimen. The costal facets are distinctly double and pedunculated, in which respect it differs widely from the later cervicals of the type and of No. 28318 of *P. rostratus*. The terminal faces are distinctly cupped, with well bevelled edges, while the hæmal ridge is much more prominent than in No. 28318, and has very deep pits on either side. The general characters of the hæmal surface accord with those of the late cervical of *P. rostratus* figured by Owen in his 'Liassic Reptilia,' pl. xi. fig. 2, in conjunction with the 16th and 17th as the 18th, but which, as mentioned above, is really much later in the series. The resemblance of this specimen to the 30th and 31st vertebræ of *P. rostratus*, No. R. 1337, indicates that those vertebræ are cervical. *No history.*

R. 1368. A mass containing four imperfect cervical and three "pectoral" vertebræ; from the Lower Lias, locality unknown. The cervicals, which are from the middle part of the series, agree with those of *P. rostratus* in their extremely short neural spines, but differ by the more depressed form of the centrum, and the more prominent hæmal ridge, which has no distinct pit on either side, The costal facets show a double articulation, although the two branches are closely pressed together. The "pectorals" are larger than in the type of *P. rostratus*, and the dorsals have the terminal faces of the centra more heart-shaped. The dimensions of one of these centra are:—length 0,048 (1·89 inches), height 0,071 (2·8 inches), width (about) 0,089 (3·52 inches). *No history.*

R. 1315. Slab showing the ventral aspect of the middle portion of a skeleton provisionally regarded as that of a young individual of the present species; from the Lower Lias of Keynsham, near Bath. The pectoral girdle is shown in a perfect condition; in advance of this are 26 cervical vertebræ with very prominent double costal facets, to which the ribs were attached only by cartilage. The proximal portion of the left pectoral limb is in its natural position, and there are three detached phalangeals. Posteriorly to the coracoids a few dorsal vertebræ, ribs, and some of the abdominal ribs are apparent. The cervical vertebræ have short centra and the posterior ones closely

resemble No. R. 1328, although the hæmal ridge is much less developed—a character which may be due to immaturity. In the pectoral girdle the portion of the coracoid in advance of the glenoidal facet is a fraction more than one fourth the entire length of bone, whereas in *P. hawkinsi* the former dimension is rather more than one third the length of the latter. In this respect, and in the circumstance that the omosternal extremity of the scapula is narrower than the coracoidal, this specimen agrees with *P. conybeari*. The omosternum is seen to have its posterior extremity embraced by and passing beneath the anterior part of the coracoids—a feature supporting Hulke's view that the former does not represent the clavicle and interclavicle.

Purchased.

Specifically undetermined specimens from the Lias, mostly referable to Plesiosaurus.

R. 1372. The crown of a tooth of medium size, in matrix; from the Lower Lias of Lyme-Regis, Dorsetshire. *No history.*

43059 a. A smaller tooth; from Lyme-Regis. This tooth is of the same type as the preceding. *Purchased*, 1871.

43059 b. A still smaller and specifically distinct tooth, in matrix; from Lyme-Regis. *Purchased*, 1871.

R. 1375. The conjoint atlas and axis vertebræ of a comparatively small species; from Lyme-Regis. *No history.*

39262. A series of six associated imperfect dorsal vertebræ united by matrix; from the Lower Lias of Lyme-Regis. These specimens indicate an individual agreeing approximately in size with *P. conybeari*. *Purchased.*

33285. A dorsal vertebra of similar type, wanting the neural spine and transverse processes; from Lyme-Regis.

Purchased, 1858.

R. 321. A polished slab showing a longitudinal section of six dorsal vertebræ of a medium-sized form; from Lyme-Regis.

Enniskillen Collection. Purchased, 1882.

R. 321 a. A fragment of rock which has been cut and polished to exhibit a longitudinal section of three dorsal vertebræ agreeing approximately in size with No. 33285.

Enniskillen Collection.

39850. A medium-sized vertebra from the "pectoral" or lumbar region, with the summit of the neural spine displaced; from Charmouth. *Purchased.*

R. 807. Four imperfect vertebræ from the "pectoral" region of a medium-sized species; from Lyme-Regis. These specimens have the left lateral aspect covered by matrix. *No history.*

R. 1376. A vertebra from the "pectoral" or lumbar region, wanting the neural spine; from Lyme-Regis. *No history.*

18970. The centrum and base of the arch of a "pectoral" or lumbar vertebra of a large species; from the Lower Lias of Watchet, Somersetshire. The centrum is relatively short. *Purchased*, 1853.

2046*. Two later caudal centra of a comparatively large form; probably from Lyme-Regis.

Hawkins Collection. Purchased, 1834.

2041*. (*Fig.*) Slab showing the imperfect anterior portion of the left side of the pectoral girdle and the humerus of the same side of a small form; from the Lower Lias, probably of Street, Somersetshire. Described and figured by Seeley in the 'Quart. Journ. Geol. Soc.' vol. xxx. p. 446, fig. 10, and referred to *Eretmosaurus*. The distal portion of the humerus underlies the scapula, and the latter has been so crushed down upon the former as to be almost welded with it, although its lateral borders can be distinctly traced. The postaxial border of the distal extremity of the scapula is in contact with the antero-external angle of the coracoid, and owing to the effects of pressure appears as though it articulated with it. In the figure and description the humerus and the anterior part of the scapula have been regarded as a single bone and described as the scapula; the proximal portion of the scapula being figured as a part of the coracoid. The suture between the scapula and the coracoid is plainly visible, the division drawn in the figure in the middle of the former being merely a fracture; the small foramen described in the coracoid is likewise merely a vacuity on a line of fracture. The specimen may be referable to *P. hawkinsi*. *Hawkins Collection.*

R. 1373. The right scapula of a comparatively small form; from Lyme-Regis. This specimen, of which the ventral surface is imperfect, not improbably belongs to *P. dolichodirus*.

No history.

32396. A rather smaller and more imperfect right scapula; from Lyme-Regis. *Purchased*, 1857.

2034*. Slab showing the outer aspect of the imperfect right scapula of a small form (? *P. hawkinsi*); probably from Street. *Hawkins Collection.*

R. 1374. Slab showing the coracoid of a small form; probably from Street. (?) *Hawkins Collection.*

R. 1391. Slab showing the dorsal aspect of the dislocated right pectoral limb of a comparatively large form; from Lyme-Regis. The dimensions of the humerus are:—length 0,278 (11 inches), width at distal extremity 0,139 (5·5 inches). The entire contour of the radius is shown, but the greater portion of the ulna is concealed; the length of the former is 0,105 (4·1 inches). *No history.*

R. 1377. The left humerus of a comparatively large form; from the Lower Lias, locality unknown. From its peculiar contour and rugose surface there is every probability that this specimen belongs to *Eretmosaurus rugosus.* *No history.*

28322. A right humerus agreeing approximately in size with the preceding, but belonging to a different species; from Lyme-Regis. *Purchased*, 1853.

41390. A larger left humerus, imperfect proximally; from the Upper Lias of Frittlingen, Würtemberg. This specimen is somewhat smaller than the corresponding bone in the skeleton of *P. homalospondylus*, but it is not improbable that it may belong to a smaller individual of that species. *Purchased.*

29887. An apparently immature left humerus; from Lyme-Regis. This specimen agrees in length with the humerus of *P. dolickodirus*, but is relatively much thicker. The rugosity of the distal extremity indicates immaturity. *Hastings Collection. Purchased*, 1855.

R. 1382. A small left humerus; from Lyme-Regis. This specimen probably belongs to *P. dolichodirus*, agreeing closely in size and contour with the corresponding bone of the type skeleton. *No history.*

46486. A left humerus of a more slender type; from Lyme-Regis or Street. Not improbably referable to *P. hawkinsi*.
Cunnington Collection. Purchased, 1875.

R. 1379. Slab exhibiting the dorsal aspect of a right humerus of the same general type as the preceding, but rather longer; probably from Lyme-Regis. *No history.*

R. 1381. A humerus of similar general type, with the proximal extremity crushed; locality unknown. *No history.*

41859. A crushed left humerus, probably belonging to *P. dolichodirus*; from Lyme-Regis. *Purchased*, 1870.

R. 1383. A crushed right humerus; from Lyme-Regis. Closely resembles the preceding specimen, but is slightly shorter.
No history.

R. 1385. A smaller and broader left humerus; probably from Street.
No history.

32393. A crushed left humerus, rather smaller than No. 41859; from Lyme-Regis. *Purchased?*

R. 1386. A small and apparently immature left humerus; locality unknown. *No history.*

32395. Two specimens of humeri, one of which is very small and immature; from Lyme-Regis. *Purchased.*

40119. A smaller immature humerus; from Lyme-Regis.
Purchased?

2143*. Slab showing one side of a small immature humerus; from Lyme-Regis or Street. *Hawkins Collection.*

28304. Slab exhibiting the ventral aspect of the right side of the pelvis, together with the femur and portions of abdominal ribs, of a species agreeing approximately in size with *P. dolichodirus* or *P. hawkinsi*; from Lyme-Regis. The greater part of the pubis is concealed by the abdominal ribs. *Purchased*, 1853.

R. 1392. Slab showing the ventral aspect of a left pubis; from Street or Lyme-Regis. Closely resembles the corresponding bone of the type skeleton of *P. hawkinsi*. *No history.*

R. 1394. Slab showing one side of a rather larger left pubis; probably from Street. This specimen agrees approximately in size with the pubis of the largest skeleton of *P. hawkinsi*.
No history.

R. 1395. Slab showing one side of a left ischium agreeing nearly in relative size with the preceding specimen; probably from Street. *No history.*

R. 879. A right (?) ilium; from Lyme-Regis. Agrees approximately in size with the ilium of No. 28304. *No history.*

R. 1393. A considerably larger ilium; locality unknown. Indicates an animal of the approximate size of *P. rostratus.* *No history.*

28323. The left femur of a large species; from Lyme-Regis. This specimen might belong to an immature individual of *Thaumatosaurus arcuatus*, since it agrees in contour, and also in its extremely rough articular surfaces, with the corresponding bone of that species. *Purchased*, 1853.

R. 1390. The left femur of a large species; from Lyme-Regis. Apparently agrees well with the femur of *P. rostratus.* *No history.*

41252. The associated right and left femur of a form agreeing approximately in size with *P. dolichodirus*; from the Lower Lias of Tewkesbury, Gloucestershire. *Purchased*, 1869.

R. 671. A slightly smaller left femur of the general type of the preceding specimens; from Lyme-Regis. *Presented by J. E. Lee, Esq.*, 1885.

32393 a. A smaller left femur; from Lyme-Regis. *Purchased.*

32393 b. A right femur apparently associated with the preceding; from Lyme-Regis. *Purchased.*

32393 c. A slightly larger left femur; from Lyme-Regis. *Purchased.*

32393 d. A rather longer left femur; from Lyme-Regis. *Purchased.*

R. 1388. A left femur; probably from Street. This specimen, which is longer than the last, is remarkable for the great prominence of the rugosity for muscular attachment at the proximal extremity of the dorsal surface. *No history.*

R. 1387. Slab showing the ventral aspect of a left femur of similar type; from Street or Lyme-Regis. *No history.*

32393 e. An imperfect right femur of the same general type; from Street or Lyme-Regis. *Purchased.*

40122. A rather smaller femur; from Lyme-Regis. *Purchased.*

R. 1389. A still smaller femur; probably from Street. *No history.*

R. 672. A small and immature femur; from Lyme-Regis.
Presented by J. E. Lee, Esq., 1885.

40123. A very small immature femur; from Lyme-Regis.
Purchased.

32723. A rolled femur of a comparatively small species; from the Upper Lias of Hortot (Manch), France.
Tesson Collection. Purchased, 1857.

R. 1396. A radius or tibia of a large species; probably from Street. This specimen is probably the radius of *Thaumatosaurus arcuatus.* *No history.*

39498. An equally large but specifically distinct radius or tibia; from the Lower Lias of Charmouth, Dorsetshire.
Purchased, 1865.

40120. A large tibia remarkable for its great relative width; from Lyme-Regis. This specimen may perhaps belong to *P. conybeari.* *Purchased.*

44908. A tibia of the same type as the preceding specimen; from the Lias, locality unknown.
Presented by Sir R. Owen, K.C.B., 1870.

28333. A radius of a medium-sized form; from Lyme-Regis. This specimen would agree approximately with the corresponding bone of *P. rostratus.* *Purchased*, 1853.

28333 a. A smaller radius of similar type; from Lyme-Regis. Might belong to *P. dolichodirus.* *Purchased*, 1853.

R. 1398. A more elongated radius; locality unknown. *No history.*

40123. A tibia of the approximate size of that of *P. rostratus*; from Lyme-Regis. *Purchased.*

R. 1397. A slightly larger and relatively wider tibia; locality unknown. *No history.*

28333 b. A somewhat similar tibia; from Lyme-Regis.
Purchased, 1853.

32396. A smaller tibia; from Lyme-Regis. *Purchased*, 1853.

11903. An ulna indicating an individual of the approximate size of *P. dolichodirus*; from Lyme-Regis. *Mantell Collection.*

R. 1399. A fibula; from Lyme-Regis. This specimen indicates an individual about the size of *P. rostratus*. *No history.*

Serial Position Uncertain.

Plesiosaurus costatus, Owen [1].

Of large size, but very imperfectly known. Cervical vertebræ with centra of moderate length; their terminal faces subcircular, deeply cupped, and without bevelling of the edges; two costal facets, of which the upper is approximated to the neuro-central suture; hæmal surface with a very prominent ridge, on either side of which is a deep ovoid pit; margins of external surface of centrum rugose.

This species was founded upon the evidence of an anterior cervical vertebra from the Rhætic of Aust Cliff, near Bristol, of which the dimensions are:—length 0,038 (1·5 inches), height 0,046 (1·8 inches), width 0,051 (2·0 inches). A very similar vertebra from the Rhætic of Autun (Saône-et-Loire), France, is described and figured by Sauvage in the 'Ann. Sci. Géol.' vol. xiv. art. 3, p. 24, pl. vi. fig. 5 (1883).

Hab. Europe (England and France).

31882. A somewhat imperfect late cervical vertebra; probably from the Rhætic [2] (Upper Trias) of the neighbourhood of Bristol. The neural spine is wanting, but the right side of the arch and centrum is well preserved. The dimensions of the centrum are:—length 0,049 (1·95 inches), height 0,059 (2·32 inches), width 0,069 (2·74 inches). This specimen agrees in all its characters with the type, showing the same deeply cupped terminal faces, the approximation of the upper costal facet to the neuro-central suture, the prominent hæmal ridge, and the rugosity of the borders of the free surface of the centrum. *Purchased*, 1859.

Of the following specimens some may belong to the present and others to the next species.

49. The crown and part of the root of a large tooth, in matrix; from the Rhætic bone-bed of the "Old Passage," near Bristol. *Presented by Sir Henry Delabeche.*

[1] Rep. Brit. Assoc. for 1839, p. 80 (1840).

[2] The matrix and mineral condition of this specimen differ from those of Lower Liassic specimens, and Mr. Etheridge has little doubt that it is really Rhætic.

23812. The imperfect crown of a very similar tooth, in matrix; from the Rhætic near Bristol. *Purchased*, 1842.

23353. The imperfect crown of a tooth of similar type, in matrix; from the Rhætic near Bristol. *Purchased*, 1842.

44832. The centrum of an anterior or middle caudal vertebra of a comparatively large species; from the Rhætic of Aust Cliff, near Bristol. The terminal faces are somewhat polygonal; the chevron-facets being confined to the posterior border. *Presented by B. Bright, Esq.*, 1873.

R. 72. The centrum of a smaller and relatively shorter caudal vertebra; from Aust Cliff.
Transferred from the Museum of Practical Geology, 1881.

48041. A bone of the paddle which is probably either an ulnare or fibulare; from the Rhætic of Aust Cliff.
Presented by Sir R. Owen, K.C.B., 1860.

Plesiosaurus bitractensis, Sauvage[1].

An imperfectly known form of considerable size. The centra of the cervical vertebræ are comparatively short, with the terminal faces deeply cupped, and the hæmal surface devoid of any ridge or pits, and its two foramina very minute and widely separated; the external surface is nearly smooth.

This species was founded upon a cervical and a dorsal vertebra from the Rhætic of Autun (Saône-et-Loire), France. The dimensions of the centrum of the former are:—length 0,042 (1·65 inches), height 0,072 (2·85 inches), width 0,080 (3·15 inches).

Hab. Europe (France and [?] England).

40117. Two vertebræ belonging either to the "pectoral" or lumbar region of a Plesiosaur either identical with or closely allied to the present species; from the Rhætic (Upper Triassic) of "Old Passage," near Bristol. These two specimens are joined together by matrix; the dimensions of the larger centrum being:—length 0,042 (1·65 inches), height 0,054 (2·12 inches), width 0,068 (2·67 inches). The costal articulations are single and placed partly on the arch and partly on the centrum. These vertebræ present all the general characters of the cervicals of *P. bitractensis*, but if belonging to the "pectoral" region indicate a small individual.
Purchased, 1866.

[1] Ann. Sci. Géol. vol. xiv. art. 3, p. 20 (1883).

Plesiosaurus posidoniæ, Quenstedt[1], of the Lias, may be identical with one of the species mentioned above.

Family LARIOSAURIDÆ.

Skull short, with the pterygoids (where known) diverging posteriorly, and infraorbital vacuities on the palate. Vertebræ resembling those of the next family. Pectoral girdle of the general type of the latter, but, at least in the type genus, without a notch at glenoidal extremity of the coracoid. Humerus somewhat shortened and expanded, with or without distal foramen; femur elongated, its length exceeding that of propodials and metapodials collectively; terminal phalangeals with claws.

The members of this family appear to connect the marine *Plesiosauridæ* with the freshwater or terrestrial *Nothosauridæ*.

Genus **LARIOSAURUS,** Curioni[2].

The type genus. Under surface of skull unknown. Cervical ribs present; humerus without distal foramen; epipodials moderately long and thick; phalangeals of pes short and thick.

The type skeleton is figured by Curioni in the 'Mem. I. R. Ist. Lombard.' vol. ix. pls. v.–vii. (1863); while a second imperfect skeleton is figured by Deecke in the 'Zeitschr. deutsch. geol. Ges.' vol. xxxiii. pls. iii., iv. (1886).

Lariosaurus balsami, Curioni[3].

The type and only known species. Length of head and body to root of tail about 0,445 (18 inches); length of skull about 0,089 (3·5 inches), of humerus 0,051 (2·0 inches).

Hab. Europe (Italy).

R. 1482. Cast of a slab showing the dorsal aspect of the entire skeleton. The original was obtained from the Lower Trias of Perleno, Como, Italy, and is preserved in the Museum at Munich. It agrees precisely with the imperfect type skeleton figured by Curioni in the 'Mem. I. R. Ist. Lombard.' vol. ix. pl. vi. (1863). The skull differs from those figured of *Conchiosaurus* by Meyer by its shorter form and the much shorter supratemporal fossæ.

Presented by Prof. K. von Zittel, 1889.

[1] Handbuch d. Petrefact. 2nd ed. p. 210 (1885).
[2] Giorn. I. R. Ist. Lombard. vol. xvi. p. 166 (1847), vol. viii. p. 478 (1847).
[3] *Loc. cit.*

Genus **NEUSTICOSAURUS,** Seeley [1].

Syn. (?) *Pachypleura*, Curioni [2].

Cervical ribs either very small or absent; humerus (at least typically) with a distal foramen; epipodials very long and slender; phalangeals of pes long and slender.

The characters by which the type of *Pachypleura* differs from that of the present genus do not appear to be of more than specific value, although the figured specimens do not show whether the humerus had a foramen.

Neusticosaurus pusillus (Fraas [3]).

Syn. *Simosaurus pusillus*, Fraas [4].

The type species. Skull comparatively short and wide; neck relatively long. Length of head and body to root of tail about 0,215 (8·5 inches); length of skull 0,030 (1·17 inches); length of humerus 0,022 (0·88 inch).

So far as the writer can see, the skeleton of *Neusticosaurus* (*Pachypleura*) *edwardsi*, Curioni [5], only differs from that of the present form by its more slender skull and larger neck, the other distinctions mentioned by Deecke not being apparent.

Hab. Europe (Germany).

R. 53. (*Fig.*) Slab showing the ventral aspect of the greater portion of the skeleton; from the Lower Keuper or Lettenkohle [6] of Hoheneck, near Ludwigsburg, north of Stuttgart, Würtemberg. One of the types; figured by Fraas in the 'Jahresh. Ver. Nat. Württ.' vol. xxxvii. pl. i. fig. 1, and also by Seeley in the 'Quart. Journ. Geol. Soc.' vol. xxxviii. pl. xiii. fig. 1; the limbs of the right side being figured on an enlarged scale on pp. 362 and 364 of the latter volume. The greater part of the caudal region and the whole of the left pelvic limb are wanting; but, with the exception of some imperfection in the other limbs, the

[1] Quart. Journ. Geol. Soc. vol. xxxviii. p. 350 (1882). This name being derived from *Neustikos* is not a synonym of *Neustosaurus*, Raspail, 'Sur un Saurien fossile,' Paris (1842), which comes from *Neustes*.

[2] Giorn. I. R. Ist. Lombard. ser. 2, vol. vi. p. 55 (1854). Preoccupied by White, 'Cat. Coleoptera Brit. Mus.' pt. vii. p. 27 (1853).

[3] Jahresh. Ver. Nat. Württ. vol. xxxvii. p. 319 (1881).—*Simosaurus*.

[4] *Loc. cit.*

[5] Giorn. I. R. Ist. Lombard. ser. 2, vol. vi. p. 55, pls. i., ii. (1854); and Mem. I. R. Ist. Lombard. vol. ix. pl. vii. fig. 2 (1863).

[6] For the serial position of these beds see Geikie, 'Text-book of Geology,' 1st ed. p. 768 (1882).

rest of the skeleton is nearly entire. The slab with detached bones from the Muschelkalk of Silesia figured by Meyer in the 'Saurier des Muschelkalk,' pl. lxvi. fig. 1, belongs either to the present or a closely allied form.

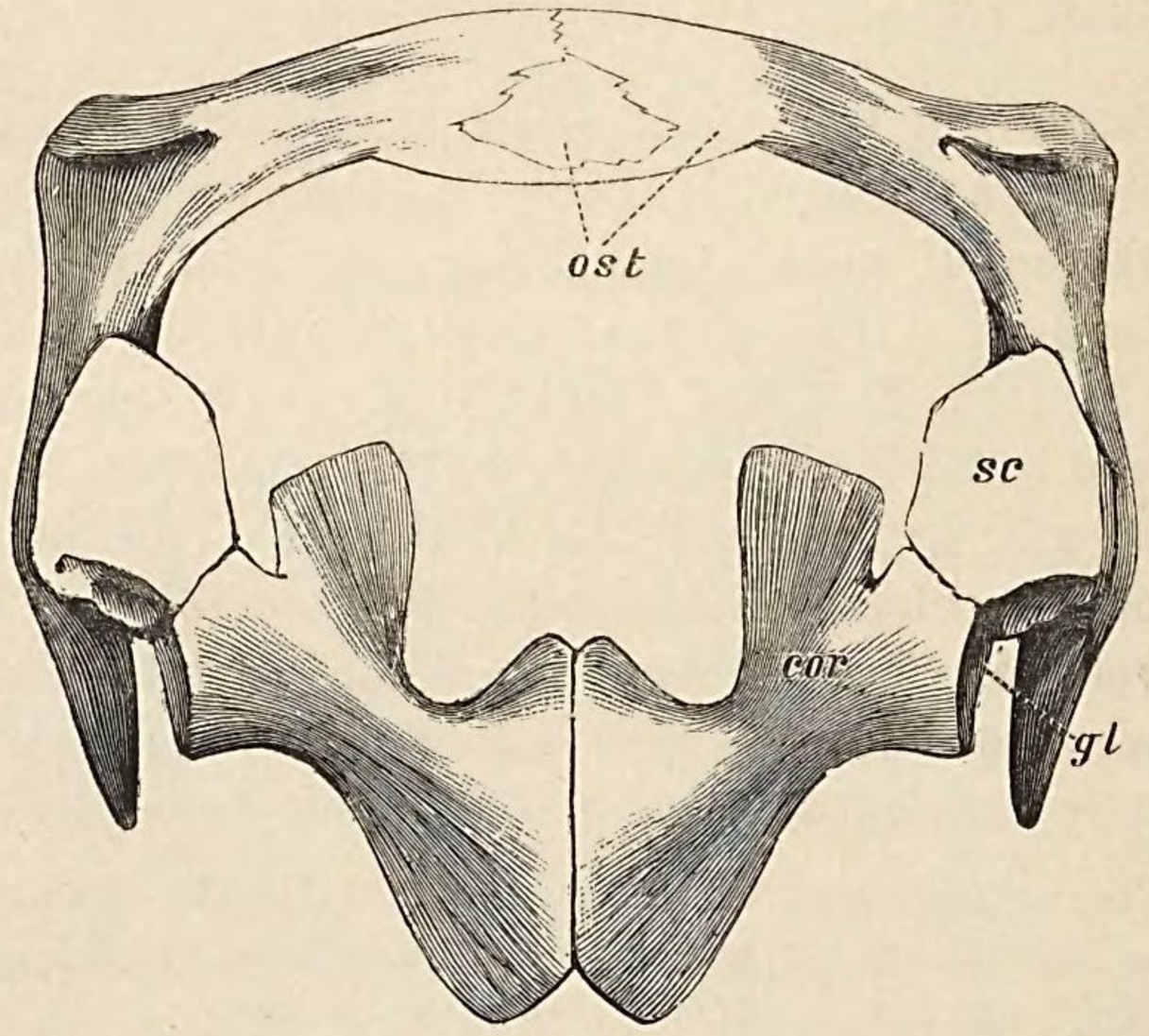
Purchased, 1881.

R. 54. (*Fig.*) Slab exhibiting the ventral aspect of a skeleton wanting the skull and anterior cervical region, the left pelvic limb, the termination of the caudal region, and the distal portions of the other limbs. The second type; portions figured by Fraas, *op. cit.* figs. 2–4, and the entire specimen by Seeley, *op. cit.* pl. xiii. fig. 2. *Same history.*

Note on MACROMEROSAURUS PLINII, *Curioni*[1].

This reptile from the Italian Trias is referred by Baur, in the 'Zool. Anzeiger,' vol. ix. p. 247[2] (1886), to the present family; but Deecke, 'Zeitschr. deutsch. geol. Ges. vol. xxxviii. pp. 190, 191, considers it to be more nearly allied to the Rhynchocephalia or Proterosauria. The pectoral girdle appears to be of a Sauropterygian type.

Fig. 82.



Nothosaurus, sp.—Ventral aspect of the pectoral girdle; from the Trias. *ost*, omosternum; *sc*, scapula; *gl*, glenoid cavity; *cor*, coracoid. Reduced.

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[1] Giorn. I. R. Ist. Lombard. vol. xvi. p. 161, and plate (1847), or vol. viii. p. 473 (1847).—*Macromirosaurus.*

[2] The family name was here given as *Macromerosauridæ*, but is changed to *Lariosauridæ* on p. 323.

Family NOTHOSAURIDÆ.

The skull long or short, with the pterygoids either diverging posteriorly, or developing alæ overlying the basicranial axis and meeting in the middle line (fig. 83); no infraorbital foramen on the palate. Anterior pectoral vertebræ with the upper costal articulation on the arch and the lower on the centrum; cervicals with double costal facets; dorsals usually with very short transverse processes, having vertically elongated articular surfaces. Scapula with small ventral (precoracoidal) plate; coracoids with short median symphysis, and a notch in glenoidal border (fig. 82); omosternal bar slender. Pubis with foramen; obturator notch open. Humerus and femur elongated; the former only slightly expanded distally, and with ectepicondylar groove; terminal phalangeals clawed. Apparently of terrestrial habits.

Genus **PISTOSAURUS,** Meyer[1].

Skull with the preorbital portion longer than the postorbital, and forming a narrow rostrum gradually narrowing towards the orbit; alæ of pterygoids not uniting beneath the basisphenoid; upper teeth not numerous, the second and third maxillary being somewhat enlarged. The dorsal vertebræ, figured by Meyer in the 'Saurier des Muschelkalk,' pl. xxvi. figs. 1–6, and provisionally referred to this genus, differ from those of the next genus by their longer transverse processes. The base of the skull is more like that of the *Plesiosauridæ* than is that of *Nothosaurus*, and it is therefore quite probable that the vertebræ were likewise more like those of the former family.

Pistosaurus longævus, Meyer[2].

The type and only described species; somewhat smaller than *Nothosaurus mirabilis*. The parietal foramen is remarkable for its great size, and there are 19 upper teeth.

Hab. Europe (Germany).

R. 19736. Cast of the cranium. The original was obtained in 1843 from the Muschelkalk of Baireuth, Bavaria, and is preserved in the Museum at Berlin. It is described by Meyer in the 'Neues Jahrb.' 1843, p. 587, and described and figured in his 'Saurier des Muschelkalk,' p. 23, pl. xxi. figs. 1–3. In the figure of the palatal aspect the occipital condyle has been introduced. *Purchased*, 1845.

[1] Neues Jahrb. 1839, p. 699.

[2] *Loc. cit.*

Genus **NOTHOSAURUS,** Münster[1].

Syn. *Dracosaurus,* Münster[2].

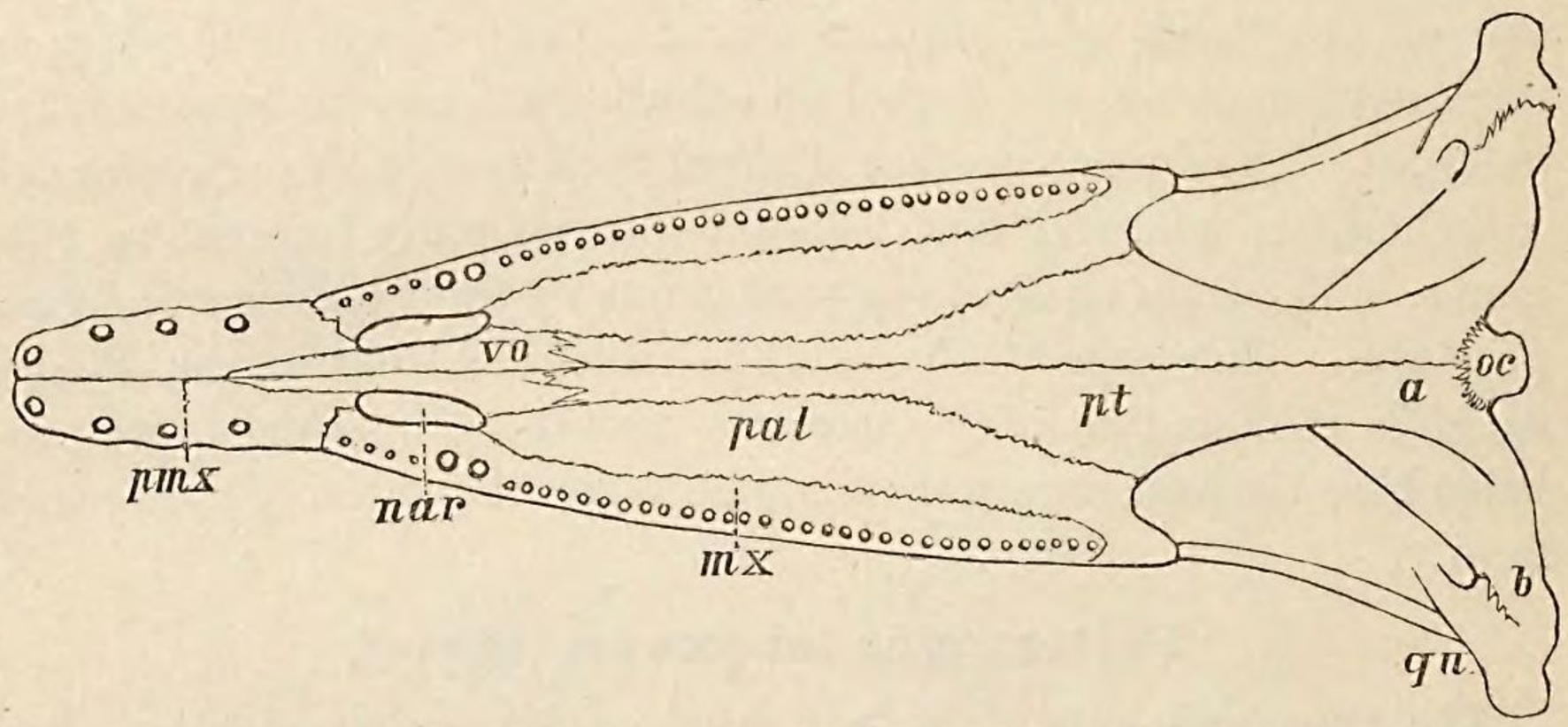
Skull long and narrow, with the postorbital portion larger than the preorbital, and with very long and narrow supratemporal fossa; alæ of pterygoids uniting beneath the basisphenoid; upper teeth numerous, with the 5th and 6th maxillary much enlarged; mandibular symphysis of moderate length, with 5 teeth. Dorsal vertebræ with very short transverse processes.

Nothosaurus mirabilis, Münster[3].

Syn. ? *Plesiosaurus speciosus,* Münster[4].
Dracosaurus bronni, Auct.[5]

The type species. Of moderate size; the length of the cranium averaging about 0,343 (13·5 inches). Premaxilla not laterally expanded, with the four teeth nearly in the same antero-posterior line; last lower symphysial tooth not recurved; 41 upper teeth.

Fig. 83.



Nothosaurus mirabilis.—Palatal aspect of the cranium; from the Muschelkalk. ¼. *pmx*, premaxilla; *nar*, posterior nares; *vo*, vomer; *mx*, maxilla; *pal*, palatine; *pt*, pterygoid; *a*, ala of do.; *b*, quadratic ridge of same; *qu*, quadrate; *oc*, occipital condyle. The posterior extremity of *pal* was probably formed by a transverse bone, but the suture is not visible.

Hab. Europe (Germany and France).

The species is typically from the Muschelkalk (Middle Trias), but the specimens from the Lettenkohle of the Lower Keuper (Upper Trias) are probably not specifically distinct.

[1] Neues Jahrb. 1834, p. 525.
[2] *Ibid.* p. 526.
[3] *Ibid.* p. 525.
[4] *Ibid.* p. 526.
[5] Commonly quoted as Münster, *op. cit.* p. 526, but only the generic name appears there.

42829. (*Fig.*) The nearly entire cranium, wanting the crowns of most of the teeth; from the Muschelkalk, probably of Baireuth, Bavaria. This specimen, of which the palatal aspect is shown in the accompanying woodcut, closely resembles the slightly smaller example figured by Meyer in his 'Saurier des Muschelkalk,' pls. ii., iii. In the restoration of the palate given in pl. i. of that work, the pterygoids are represented as extending forwards to unite with the premaxillæ, but the present specimen shows most distinctly that the vomers intervene and form the median bar dividing the apertures of the posterior nares. The lateral borders of the channel of bone overlying the basicranial axis are clearly formed by alæ of the pterygoids, after the manner of the Chelonian *Podocnemis*; but it seems from the presence of a median suture shown in several of Meyer's figures, and of which there appear to be traces in the present specimen, that these alæ united mesially as far back as the occipital condyle. In *Podocnemis*, where the occipital condyle is situated posteriorly to the articular surface of the quadrate, these bones diverge posteriorly to expose the basioccipital and basi- and presphenoid. The ridge of bone marked *b* in the figure clearly corresponds to the vertical ridge of the pterygoids in *Podocnemis*, which articulates with the quadrate; this representing the entire posterior portion of the pterygoids of Lizards. The entire absence of infraorbital foramina on the sides of the palate is well shown.

Van Breda Collection. Purchased, 1871.

38633. Portions of the two rami of a mandible in matrix, probably belonging to this speices; from the Lettenkohle of the Lower Keuper [1] of Hoheneck, near Ludwigsburg, north of Stuttgart, Würtemberg. This specimen is broken off anteriorly at the commencement of the symphysis, the last of the large symphysial teeth still remaining; posteriorly the greater portion of the dentary is preserved. This specimen agrees closely with the nearly entire anterior portion of the mandible from the Muschelkalk figured by Meyer, *op. cit.* pl. xiii. *Purchased*, 1864.

[1] See note 6 on p. 285.

Of the following specimens, which agree more or less nearly in relative size with the skull, some probably belong to this, the commoner species, while others may be distinct.

1104, 1092 a. Two crowns of teeth in matrix; from the Muschelkalk of Baireuth. *Purchased.*

40130. The crown of a smaller tooth in matrix; from Baireuth. *Purchased.*

R. 253. The crowns of two teeth in matrix; from Baireuth. *Egerton Collection. Purchased*, 1882.

43626. The imperfect crown of a similar tooth; from the Sandstone of the Lettenkohle of Bibersfield, Würtemberg. This bed immediately overlies the Muschelkalk. *Purchased*, 1859.

33088. The crowns of four teeth in matrix; from the bone-bed of the Upper Muschelkalk of Crailsheim, Würtemberg. *Purchased*, 1848.

44823. The crown of a tooth in matrix; from the Muschelkalk of Baireuth. *Presented by B. Bright, Esq.*, 1873.

48201. A slightly imperfect cervical vertebra, wanting the greater part of the neural spine; from Baireuth. The dimensions of the centrum are:—length 0,025 (0·96 inch), width 0,026 (1·02 inches), height 0,022 (0·86 inch). In general characters this specimen closely accords with the cervicals of the vertebral column figured by Meyer, *op. cit.* pl. xxiii., and referred to *Nothosaurus mirabilis*; but it is smaller than the cervicals figured on pls. xxiv. and xxv. under the same name, and also differs by the absence of a hæmal ridge on the centrum. *Purchased*, 1877.

48201 a. A nearly entire but somewhat crushed anterior "pectoral" vertebra, wanting the greater part of the neural spine; from Baireuth. This specimen, which was probably associated with the preceding, agrees generally with the corresponding vertebræ of the above-mentioned column, and shows the Crocodilian feature of having the upper costal facet on the arch and the lower on the centrum. *Purchased*, 1877.

1094. The crushed centrum of a very early dorsal vertebra; from Baireuth. *Purchased. About* 1836.

1093. The centrum of a rather later dorsal vertebra ; from Baireuth. The contour of the terminal faces is transversely elliptical, as in all the preceding specimens. *Purchased*, 1877.

38704. A late dorsal vertebra, partly imbedded in matrix, with the centrum and arch laterally flattened by pressure ; from Baireuth. This specimen accords well with the posterior dorsals of the vertebral column figured by Meyer ; the height of the neural spine being 0,098 (3·85 inches), and the length of the centrum 0,029 (1·14 inches). Its resemblance to the dorsal figured on pl. xxiv. fig. 3 is also strongly marked. The contour of the terminal faces of the centrum is vertically elliptical. *Purchased*, 1869.

1091. The arch and spine (wanting the summit) of a dorsal vertebra, in matrix ; from Baireuth. This specimen, of which the posterior aspect is exposed, closely accords with the arch of the entire dorsals figured by Meyer, *op. cit.* pl. xxiv. figs. 4, 5. The diameter across the transverse processes is 0,065 (2·56 inches). *Purchased. About* 1836.

R. 253 a. An imperfect anterior caudal vertebra, in matrix ; from Baireuth. Agrees with the specimen figured by Meyer, *op. cit.* pl. xxv. fig. 11. *Egerton Collection.*

48202. A laterally crushed late caudal vertebra, wanting the neural spine ; from Baireuth. Resembles the specimen figured by Meyer on pl. xxv. fig. 5. *Purchased*, 1877.

33082. Slab showing the dorsal aspect of an imperfect right scapula ; from the dolomite of Hoheneck. *Purchased*, 1848.

33088 a. An imperfect rib, in matrix ; from the Upper Muschelkalk of Crailsheim. *Purchased*, 1848.

42811. Slab showing an abdominal rib ; from the Muschelkalk of Baireuth. *Van Breda Collection.*

35679. Slab showing a smaller abdominal rib ; from Baireuth. *Purchased*, 1859.

R. 1405. Slab showing a still smaller abdominal rib ; probably from Baireuth. *No history.*

38674. Fragment of rock showing the dorsal aspect of a crushed right scapula from the Lettenkohle of Hoheneck. This specimen agrees in size with the scapulæ figured by Meyer, *op. cit.* pl. xxxiv. *Purchased*, 1864.

38676. A crushed coracoid, agreeing in size with the restoration of the same element in the above-quoted figure; from Hoheneck. *Purchased*, 1864.

38672. An imperfect coracoid belonging to the side opposite to that to which the last specimen pertained; from Hoheneck. *Purchased*, 1864.

48203. The symphysial portion of a coracoid in an uncrushed condition; from the Muschelkalk of Bavaria. *Purchased*, 1877.

1083 a. An imperfect right humerus; from the Muschelkalk of Baireuth. This specimen, which has lost the two extremities, agrees approximately in size with the entire example figured by Meyer, *op. cit.* pl. xliv. fig. 1, of which the length is 0,268 (10·6 inches). The entepicondylar foramen is preserved, although filled with matrix, and there is also a portion of the ectepicondylar groove. (See No. 40052, p. 296.) *Purchased. About* 1836.

42831. The proximal half of a nearly similar right humerus; from the Muschelkalk, probably of Würtemberg. *Van Breda Collection.*

1083 b. A right humerus, wanting the distal third; from Baireuth. *Purchased. About* 1836.

R. 253 b. The imperfect distal extremity of a similar right humerus; from Baireuth. *Egerton Collection.*

38675. Slab exhibiting the left side of the pelvis; from Hoheneck. The ventral aspect is shown of the pubis and ischium in their natural position; the former has an imperfectly closed foramen at its ischial articulation, and the obturator notch is widely open. The matrix has been cut away to exhibit the whole of the ilium and the contour of the acetabulum. *Purchased*, 1864.

38676. A right ilium, agreeing closely with the corresponding bone of the preceding specimen; from Hoheneck. *Purchased*, 1864.

38678. A right pubis, in matrix; from Hoheneck. This specimen closely resembles the corresponding bone of No. 38675, and may have belonged to the same individual. *Purchased*, 1864.

33076. Slab exhibiting the ventral aspect of a rather smaller and perhaps specifically distinct left pubis; from Hoheneck. *Purchased.*

33079. Slab showing the dorsal aspect of a similar left pubis; from Hoheneck. *Purchased.*

38680. A flattened ischium, closely resembling the corresponding bone of No. 38675; from Hoheneck. *Purchased*, 1864.

1085. An imperfect ischium of somewhat larger size; from the Muschelkalk of Baireuth. *Purchased. About* 1836.

38679. Slab showing both sides of the articular head and one lateral surface of a smaller ischium; from Hoheneck. *Purchased*

46732. A femur, wanting the terminal epiphyses; from Baireuth. This specimen, which would agree in relative proportions with the above-mentioned specimens of the humerus, is intermediate in size between the two femora figured by Meyer, *op. cit.* pl. xlviii. figs. 1, 2. *Purchased*, 1874.

1084. A crushed femur of similar type, belonging to the opposite side, which has likewise lost its epiphyses; from Baireuth. *Purchased. About* 1836.

38690. An epipodial bone; from Hoheneck. *Purchased*, 1864.

38691. An epipodial bone, not homologous with the last; from Hoheneck. *Purchased*, 1864.

Nothosaurus giganteus, Münster [1].

Syn. *Dracosaurus giganteus*, Auct.
(?) *Nothosaurus aduncidens*, Meyer [2].

Imperfectly known, but apparently attaining dimensions double those of the type species. This species was founded upon fragments of a skull from the Muschelkalk figured by Meyer in his 'Saurier des Muschelkalk,' pl. xi. It is not apparent how the hinder portion of a cranium and fragment of a mandible figured in pl. lxvii. as *N. aduncidens* can be specifically distinguished; the last symphysial tooth of the latter is recurved.

Hab. Europe (Germany and France).

[1] Neues Jahrb. 1834, p. 525.
[2] Saurier des Muschelkalk, p. 85 (1847–55).

The following specimens would agree, in respect of size, with the skull of the present form, but some of them may be referable to Simosaurus, *while if* Nothosaurus aduncidens *be a distinct species, they might equally well belong to that form.*

1103. The centrum of a "pectoral" vertebra; from the Muschelkalk of Seineck, near Baireuth, Bavaria. The dimensions are:—length 0,043 (1·68 inches), width 0,058 (2·28 inches), height 0,056 (2·2 inches). The lower costal facet, although somewhat obscure, is seen on the centrum, but closely approximated to the neuro-central suture.

Purchased. About 1836.

42832. A late dorsal vertebra, wanting the neural spine; from the Muschelkalk, probably of Würtemberg. This specimen would agree approximately in relative size with the preceding, and also with the earlier dorsal centrum figured by Meyer in the 'Saurier des Muschelkalk,' pl. xxiv. figs. 8, 9, under the present specific name. The dimensions of the centrum are:—length 0,047 (1·45 inches), width 0,052 (2·05 inches), height 0,053 (2·08 inches), and the diameter across the transverse processes 0,094 (3·7 inches). On the left side the vertically elongated articular face of the transverse process shows traces of a division into two portions.

Van Breda Collection. Purchased, 1871.

1092. The arch of a rather smaller dorsal vertebra; from Baireuth. The diameter across the transverse processes is 0,077 (3·05 inches). This specimen should perhaps be referred to the smaller *N. adriani*, Meyer, or to *Simosaurus*.

Purchased. About 1836.

38706. The crushed neural arch of a very large dorsal vertebra; from the Lettenkohle [1] of the Lower Keuper of Hoheneck, near Ludwigsburg, north of Stuttgart, Würtemberg. The transverse diameter across the costal articulations is 0,119 (4·7 inches), but this is considerably exaggerated by pressure.

Purchased, 1864.

R. 309. One longitudinal half of the centrum of a dorsal vertebra, agreeing approximately in size with No. 42832; from the Muschelkalk of Breslau. The inner surface has been polished.

By exchange, 1883.

[1] See note 6, p. 285.

38708. Two slabs, one containing an anterior, and the other a posterior rib of a very large animal; from Hoheneck.
Purchased, 1864.

38708 a. The proximal portion of a rib agreeing in size with the preceding; from Hoheneck. *Purchased*, 1864.

38694. A specimen which appears to be part of a very large abdominal rib; from Hoheneck. *Purchased*, 1864.

42830. An imperfect left humerus; from the Muschelkalk, probably of Würtemberg. This specimen appears to accord fairly well in relative size with the imperfect coracoids figured by Meyer, *op. cit.* pl. xxxvii. fig. 1, and pl. xxxix. fig. 1, and provisionally referred to *N. giganteus*.
Van Breda Collection.

Genus **CONCHIOSAURUS,** Meyer[1].

Closely allied to *Nothosaurus*, but with the crowns of the cheek-teeth clavate as in *Simosaurus*.

Conchiosaurus clavatus, Meyer[2].

Syn. *Nothosaurus venustus*, Münster[3].

The type and only known species; about one half the dimensions of *Nothosaurus mirabilis*.

The type cranium is figured by Meyer in his 'Saurier des Muschelkalk,' pl. x. figs. 2–4; and that of the so-called *N. venustus* in figs. 5–6 of the same.

The undermentioned specimens being the remains of the smaller forms found in the German Muschelkalk, and agreeing more or less nearly in relative size with the crania, it is probable that at least a moiety of them are referable to the present species; although some of the smallest may belong to *Lariosaurus*.

Hab. Europe (Germany).

40051. Ten imperfect and apparently associated vertebræ; from the Muschelkalk of Nurnberg, Bavaria. Two of the detached centra (No. 40051 *a*) belong to the anterior part of the cervical region, the larger having a length of 0,012 (0·46 inch); they show very distinctly the double costal facets, of which the uppermost join the surface for the attachment of the arch. The two specimens in which the arch is still retained apparently belong to the pos-

[1] Museum Senckenberg. vol. i. p. 8 (1834).
[2] *Loc. cit.*
[3] Neues Jahrb. 1834, p. 525.

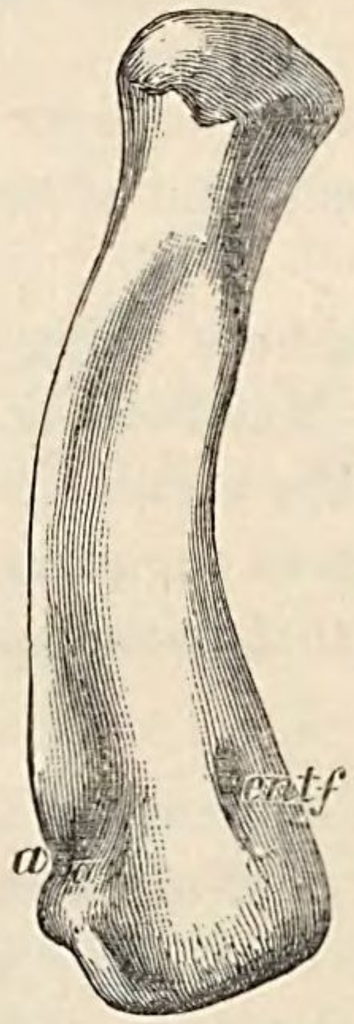
terior part of the "pectoral" region; the dimensions of their centra are:—length 0,018 (0·58 inch), height 0,009 (0·35 inch), width 0,009 (0·35 inch). The remaining centra are from the dorsal and lumbar or anterior caudal regions. *Purchased*, 1866.

1096. Three centra of dorsal vertebræ; from the Muschelkalk of Baireuth, Bavaria. *Purchased.*

R. 1406. The arch of a dorsal vertebra agreeing approximately in size with the preceding; from the Muschelkalk. The diameter across the transverse processes is 0,033.
No history.

40054. A coracoid, in two portions and somewhat imperfect; from Nurnberg. This specimen appears to have been associated with the vertebræ No. 40051. Its relative proportions to these specimens and also to the type skull are approximately similar to those obtaining between the corresponding elements of *Neusticosaurus*. The antero-posterior diameter at the median symphysis is 0,037 (1·45 inches).
Purchased, 1864.

Fig. 84.



(?) *Conchiosaurus clavatus*.—Ventral aspect of the right humerus; from the Muschelkalk of Nurnberg. $\frac{1}{2}$. *ent.f*, entepicondylar (ulnar) foramen; *a*, ectepicondylar groove.

40052. A right humerus, associated with the preceding. Figured (*Fig.*) in the accompanying woodcut. The length is 0,103 (4·05 inches). The specimen has been somewhat water-

worn, which exposes part of the long proximal epiphysis extending nearly to the middle of the shaft. The entepicondylar foramen is distinct, and the ectepicondylar groove is also well shown. *Purchased*, 1864.

40053. A femur, associated with the preceding. Length 0,118 (4·65 inches). *Purchased*, 1864.

40054 a. Part of a rib, associated with the preceding. *Purchased*, 1864.

38685. Slab containing a coracoid intermediate in size between No. 40054 and the next specimen; from the Triassic dolomite of Hoheneck, Würtemberg. *Purchased*, 1864.

R. 1407. Slab showing one surface of a coracoid of somewhat smaller size than No. 40054; from the Muschelkalk, locality unknown. The antero-posterior diameter of the symphysis is 0,028 (1·1 inches), and the transverse diameter of the entire specimen 0,051 (2·0 inches). This specimen would agree in relative size with the skull on which *Nothosaurus venustus* was founded. *No history.*

R. 1408. Slab showing the corresponding aspect of a slightly smaller but otherwise similar coracoid; from the Muschelkalk of Querfurt, Prussian Saxony. The symphysial extremity is imperfect. *No history.*

R. 1409. A right humerus in matrix, agreeing approximately in relative size with the preceding; from the Muschelkalk. Length 0,067 (2·64 inches). *No history.*

R. 1410. A femur in matrix, wanting the distal extremity; from the Muschelkalk. This specimen would accord in relative size with the preceding. *No history.*

Specimens of which the genus cannot be determined.

38667. The crowns of two comparatively large teeth, in matrix from the Lettenkohle of Hoheneck. *Purchased*, 1864.

1108. The centrum of a medium-sized late "pectoral" or lumbar vertebra; from the Muschelkalk of Baireuth. *Purchased.*

1109. The centrum of an early pectoral vertebra; from Baireuth. *Purchased.*

48201 x. The centra of two smaller dorsal vertebræ; from Baireuth. *Purchased*, 1877.

38707 a. The centrum of a vertebra probably belonging to the lumbar region; from Hoheneck. *Purchased*, 1864.

33085. The centrum of a comparatively small cervical vertebra; from the Middle Triassic bone-bed of Crailsheim. *Purchased*, 1848.

33085 a. The centra of two dorsal vertebræ, which may have been associated with the preceding; from Crailsheim. *Purchased*, 1848.

33085 b. The centrum of a larger dorsal vertebra; from Crailsheim. *Purchased*, 1848.

33085 c. Three larger vertebral centra belonging either to the "pectoral" or lumbar region; from Crailsheim. *Purchased*, 1848.

1106. The centrum of a comparatively small dorsal vertebra; from Baireuth. *Purchased. About* 1836.

38670. The middle portion of the omosternum of a large form; from Hoheneck. This specimen evidently belongs to an animal generically distinct from that to which the next example pertained. *Purchased*, 1864.

38669. The right side of the anterior portion of the pectoral girdle; from Hoheneck. This specimen, which shows the scapula, and the right lateral and mesial elements of the omosternum, agrees precisely in contour with the larger example figured by Meyer in his 'Saurier des Muschelkalk,' pl. xxxiv.; it probably belongs to *Nothosaurus*. The figure of the pectoral girdle given on p. 286, is partly based on this specimen. *Purchased*, 1864.

40666. Slab exhibiting one surface of a large coracoid, with the scapular extremity imperfect; from Hoheneck. This specimen agrees approximately with the one figured by Meyer, *op. cit.* pl. xxxviii. fig. 2; the antero-posterior diameter at the symphysis being 0,125 (4·94 inches), and the transverse diameter 0,218 (8·6 inches). *Purchased.*

38673. A split slab containing a smaller coracoid, which has been mesially slit; from Hoheneck. *Purchased*, 1864.

38689. A comparatively large and flattened right humerus, wanting the middle of the shaft. There is no trace of the entepicondylar foramen. *Purchased*, 1864.

38666. A flattened right humerus, wanting the distal extremity; from Hoheneck. *Purchased*, 1864.

38677. An imperfect ilium; from Hoheneck. *Purchased*, 1864.

38683. A medium-sized ischium, in matrix; from Hoheneck. *Purchased*, 1864.

38681. A smaller ischium; from Hoheneck. *Purchased*, 1864.

38682. A nearly similar ischium; from Hoheneck. *Purchased*, 1864.

38692. A medium-sized femur; from Hoheneck. *Purchased*, 1864.

List of Genera and Species of Triassic Sauropterygia not mentioned above.

a. *From the Keuper dolomite of Molsdorf.*

Nothosaurus bergeri, Meyer [1].

b. *From the Muschelkalk of Germany or France.*

Nothosaurus andriani, Meyer [2].
Nothosaurus muensteri, Meyer [3].
Nothosaurus mougeoti, Meyer [4].
Syn. *Simosaurus mougeoti*, Meyer [5].
Nothosaurus angustifrons, Meyer [6].
Simosaurus guillardoti, Meyer [7].
Simosaurus guillielmi, Meyer [8].
Nothosaurus schimperi, Meyer [9].

c. *Horizon uncertain.*

Plesiosaurus profundus, Zenker [10].
Plesiosaurus jenensis, Zenker [11].

[1] Saurier des Muschelkalk, p. 150 (1847–55).
[2] Neues Jahrb. 1839, p. 559.
[3] *Loc. cit.*
[4] *Ibid.* 1842, p. 196.—*Simosaurus.*
[5] *Loc. cit.*
[6] Beiträge päl. Württembergs, p. 47 (1844).
[7] Neues Jahrb. 1842, p. 196. For synonymy see Gervais's 'Zool. et Pal. Françaises,' 1st ed. p. 268.
[8] Saurier des Muschelkalk, p. 72 (1847–55).
[9] *Ibid.* p. 134.
[10] Beiträge z. Naturg. Urwelt, p. 64 (1833).
[11] *Ibid.* p. 65.

Family MESOSAURIDÆ.

Skull long and slender, but its palatal structure unknown. Vertebræ with a notochordal canal and relatively small centra, apparently of the same general structure as those of the *Nothosauridæ*. Ribs very thick and apparently anchylosed to the vertebræ. Pectoral and pelvic girdles and limb-bones of the general type of those of the latter; five distinct tarsalia in pes, of which the fifth digit is the longest. The structure of the pes would seem to indicate a webbed foot like that of Frogs.

The so-called *Stereosternum*, on account of the presence of five bones in the distal row of the tarsus, has been made by Baur ('Morphol. Jahrb.' vol. i. p. 103, 1887) the type of a distinct order, under the name of *Proganosauria*; there can, however, be no question but that such a character cannot be allowed to outweigh its manifest affinity to the *Nothosauridæ* (*vide* Seeley, 'Phil. Trans.' 1888, pp. 104, 105).

Genus **MESOSAURUS,** P. Gervais [1].

Syn. *Stereosternum*, Cope [2].

The type and only known genus, *Stereosternum* presenting no characters by which it can be distinguished [3].

Mesosaurus tenuidens, P. Gervais [4].

The type species. Length of mandible 0,064 (2·53 inches), and of humerus 0,026 (1·02 inches). The size of the entire animal is approximately the same as that of *Sphenodon*.

Hab. South Africa.

49659. A cast taken from a slab of shale showing the impression of the ventral aspect of the anterior half of the skeleton. The original specimen is the type, and was obtained from the Karoo system (probably Lower Mesozoic) of Griqualand West, and is preserved in the Paris Museum. The cast in relief is figured by P. Gervais in his 'Zool. et Pal. Générales,' sér. 1, pl. xlii., and the left pectoral limb in the accompanying woodcut. The skull and both pectoral limbs are well preserved, but the characters of the pec-

[1] Zool. et Pal. Générales, sér. 1, p. 223 (1867–69).

[2] Proc. Amer. Phil. Soc. vol. xxiii. p. 7 (1886).

[3] The detached coracoid figured by Cope, *op. cit.* pl. i. fig. 8, must belong to a different reptile.

[4] *Loc. cit.*

toral girdle are imperfectly displayed. Between the vertebral column and the right pectoral limb is a body regarded by Gervais as probably Crustacean.

Presented by the Paris Museum of Natural History.

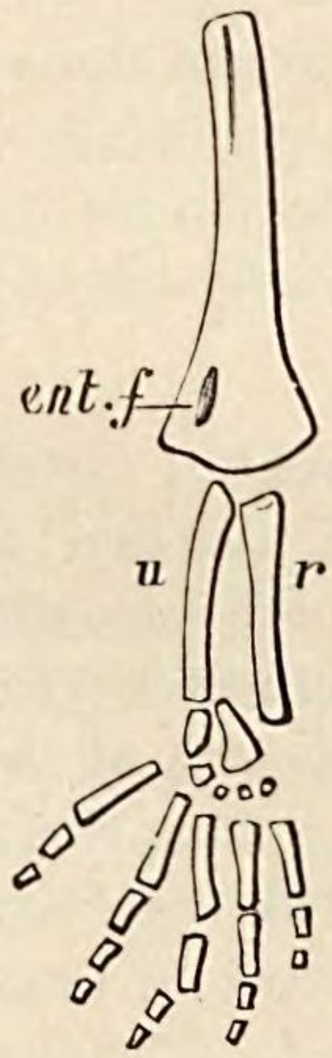
49971. Slab of shale showing the impression of the dorsal aspect of part of the dorsal region of the vertebral column and ribs; from the Karoo system of Kimberley, Griqualand West. A plaster cast in relief has been taken from this specimen.

Presented by M. Marcus, Esq., 1878.

49972. Fragment of shale showing the impression of the ventral aspect of part of the dorsal region of the vertebral column and ribs; from Kimberley. A plaster cast exhibits the features of this specimen in relief.

Presented by W. Benstead Smith, Esq., 1878.

Fig. 85.



Mesosaurus tenuidens.—Ventral aspect of the left pectoral limb; from the Karoo system of Griqualand West. $\frac{1}{1}$. *ent.f*, entepicondylar foramen of humerus; *r*, radius; *u*, ulna.

49973. Slab of shale showing a lateral impression of the anterior caudal region, together with a few of the vertebræ themselves; from Kimberley.

Presented by Captain J. Scott Helps, 1878.

49974. Fragment of shale exhibiting the impression of the ventral and left lateral aspect of part of the anterior caudal region,

together with that of the ventral aspect of the left pes; from Kimberley. A plaster cast in relief has been taken of the caudal vertebræ. Although rather smaller this specimen closely resembles the corresponding regions of the skeleton of the American form figured by Cope. The five rows in the distal row of the tarsus are distinctly shown; and the fifth digit, which is incomplete in Cope's specimen, is entire. The numbers of the phalangeals in the five digits are 2, 3, 4, 5, 4; the fifth digit being the longest. *Presented by Captain J. Scott Helps*, 1878.

49974 b. Slab of shale showing an impression of part of the caudal region and of the distal extremity of the right pes of the same individual. *Presented by Capt. J. Scott Helps*, 1878.

Mesosaurus tumidus (Cope [1]).

Syn. *Stereosternum tumidum*, Cope [2].

So far as can be seen at present there appear to be no characters by which this form can be specifically distinguished from the type species; but since it has received a distinct name and is from a widely distant locality it is provisionally allowed to stand as a species.

Hab. South America.

R. 536. Slab showing the ventral surface of the dorsal and part of the caudal region, together with the impression of the dorsal aspect of the imperfect limbs and the anterior part of the caudal region; from beds which are probably of Lower Mesozoic age at San Paolo, Brazil. A plaster cast has been taken from this specimen, which shows the limbs in relief. This specimen agrees precisely with the type skeleton figured by Cope in the 'Proc. Amer. Phil. Soc.' vol. xxiii. pl. i. The distal row of the tarsus is not clearly shown; the humerus, allowing for the circumstance that the dorsal aspect is seen in the one and the ventral in the other specimen, is absolutely indistinguishable from that of the type skeleton of *M. tenuidens*, the entepicondylar foramen being clearly shown. A skeleton from the same deposits is described by Cope in the 'Amer. Nat.' vol. xxi. p. 1109, which shows the skull. The foramen on the humerus is described as being ectepicondylar, which

[1] Proc. Amer. Phil. Soc. vol. xxiii. p. 7 (1886).—*Stereosternum.* [2] *Loc. cit.*

would appear to be an error. There is no sufficient evidence to support the view taken by Cope as to the probably Carboniferous age of the beds from which these specimens were obtained. *Purchased*, 1885.

R. 537. Slab showing the ventral aspect of the imperfect dorsal region; from San Paolo. *Purchased*, 1885.

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